MEXICO'S TREASURE-HOUSE (GUANAJUATO)

BY PERCY F. MARTIN, F.R.G.S.

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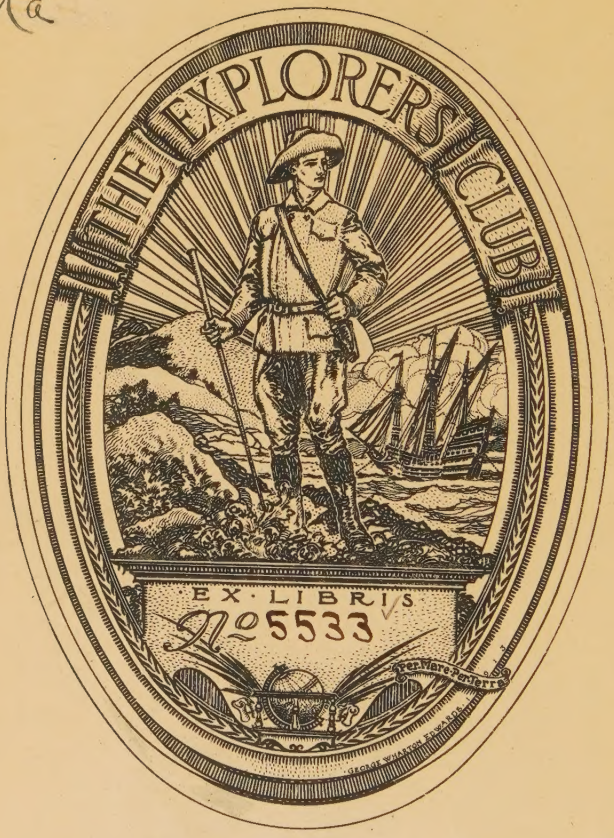

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MEXICO'S TREASURE-HOUSE

MEXICO'S TREASURE-HOUSE (GUANAJUATO)

An Illustrated and Descriptive Account of The Mines and Their Operations in 1906

BY

PERCY F. MARTIN, F.R.G.S.
Author of "Through Five Republics (of South America) 1905"

"I AM not blind to the unison of opinion as expressed by scientists and experts that Mexico will one day furnish the gold, silver and copper of the world; that from her hidden vaults, her subterranean treasure houses, will come the gold, silver, copper and precious stones that will build the empires of to-morrow and make future cities of this world veritable New Jerusalems."
—*The late Cecil Rhodes.*

44 PAGES ILLUSTRATIONS 6 PANORAMIC VIEWS
2 MAPS AND DIAGRAMS

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PREFACE.

"Know thy opportunity."
—PITTACUS.

WORKS UPON MEXICO, although not numerous, have, of late years at least, been readily procurable; but for the most part they have dealt with the past history of the Republic, relating to its early troubles and ignoring the present and future greatness of this remarkable country.

In regard to Mexico's principal asset, viz: its mines, I can but repeat the words of the poet Byron, that "the best of prophets of the future, is the past"; and if only what has been will be again the mineral wealth of all the rest of the world will have to stand the test of keen comparison, and must be prepared to meet with a shock of surprise.

A temporary visit to the Guanajuato district, where a great revival of interest among the mines has set in, convinced me that were the investing public of the United States and Great Britain to know something more than they do about this very remarkable mineral camp, it must prove of infinite benefit to them and of material advantage to Guanajuato itself.

Thus, in my travels through Mexico for the purpose of collecting materials for a book on the whole of the Republic—which is to be published towards the middle of next year—I found it expedient to tarry awhile in

Guanajuato, and there to study the conditions and prospects of a district which I always believed, and now know, will one day not far distant rival the famous Rand itself, and prove to be an important apartment in that "treasure-house" from which will come the gold, silver, copper and precious stones "that will build the empire of to-morrow, and make future cities of this world veritable Jerusalems," which were the words in which the late Cecil Rhodes once described Mexico.

"Civilizing by syndicate" is not a bad method to adopt, provided the members of such "syndicate" are men of honor as well as enterprise, and both remember and observe the conditions under which this kind of civilization should be conducted,—that is to say, so as to benefit the country generally as well as to enrich themselves. The Anglo-Saxon races have already "cornered," if I may adopt such a term, four-fifths of the gold-producing mines of the world, and it is, therefore, eminently fit that the magnificent mineral interests of Mexico should be likewise mainly in their hands. But for British capital in the first instance and more from America in the second, probably the mineral riches of Mexico might have lain dormant or but imperfectly developed for many years, neither the Spanish pioneers nor the Mexican proprietors having had the means or the scientific knowledge to work the mines beyond a certain point. Foreign capital and foreign brains have, however, joined together to some purpose, and the consequence of this combination must be as beneficial to Mexico and to the Mexicans as to the enterprising financiers who have come forward at the psychological moment to help in the country's development.

The Guanajuato gold and silver mines differ from most other mines of the world inasmuch as there is absolutely nothing conjectural nor problematical about them. For close upon four hundred years they have been not only known but actively worked, and they have from first to last contributed about three-fifths of the total amount of the world's supply of silver. "Imagination rules the world," as Napoleon once declared; there is, however, no sort of imagination about this statement.

In this unpretentious volume I have attempted, to the best of my ability, to provide some description of an exceptionally promising mining district, and before all the good things in it have been appropriated. It is not unusual to proclaim the virtues of an individual after his death, ignoring all his abilities and attributes while he is still preserved among us. Much about the same kind of policy is adopted with regard to profitable commercial enterprises, which are not infrequently introduced to public notice after the cream has been licked off by favored insiders.

Probably this might have been the case with the Guanajuato gold and silver mines, but for the fortunate circumstance which brought me here and which has enabled me to learn something of the district which is destined shortly to astonish the investing world under the new régime of improved treatment and scientific development through which it is passing. I honestly believe that Guanajuato is destined to take first rank among the gold and silver camps of the world, and it is because of this conviction that I desire Anglo-Saxon investors, who have followed my writings for some twenty

years upon both sides of the Atlantic, to share in the golden possibilities which are here unfolded.

In this treasure-house of Mexico—Guanajuato—are vast riches which may still to-day be shared-in by those who have early knowledge of their opportunities and who do not hesitate to avail themselves of them. The time is not yet when everything in the shape of a sound Guanajuato property is "up in the skies," as is the case with some other Mexican mines, such as the Dos Estrellas in Michoacán State, the shares, of $100 each, of which are selling for $8,500 and have been sold at the stupendous figure of $9,500. When it is remembered that in Mexico between the years 1887 and 1889 as much as $14,401,648 (say £2,880,000) was produced by the mines of Guanajuato alone, sufficient should have been said to prove the great value of these mines and the rational probability of their continuing to yield handsome returns to their fortunate proprietors.

Those who trouble to read the following pages will realize why it is that these mines are passing into the hands of Anglo-Saxon capitalists one by one, and how the opportunities which exist to-day for participating in this attractive enterprise may soon fade away.

I would desire to point out that in the subjoined chapters I have not availed myself of the privilege claimed by so many writers, and assumed the mantle of the prophet. I have contented myself with speaking of things as they actually are or have been, rather than as they may be; permitting my readers to draw their own conclusions, which the *data* and descriptions afforded should enable them readily to do.

From my varied experiences, gathered upon nearly

every gold-field of the world and a quarter-of-a-century's uninterrupted writings upon such forms of investment, I feel certain that no necessity exists for "cramming facts down the throats" of the intelligent reading public. I provide the material, collected and sifted, if I may say so, with much care and no small amount of trouble; it is for those who read them to accept or reject the statements therein set forth.

I can only say, however, that those who enter now into the but partially occupied field of industry which the gold and silver mines of Guanajuato hold open, before the finest of these opportunities have been seized upon and closed, should have but little cause to regret their decision. The invaluable adjuncts of a stable government, a settled country and the best class of financial interests of the United States and Great Britain represented in the management at work, are all here; these should form the best recommendations, next to the unquestioned richness of the mines themselves, for all who are desirous of participating in Mexico's treasures.

Those who have formed the impression that the Rand in the Transvaal is the only wonderful producer in the world, and who have heard of the celebrated West Australian and British Columbian mines, have probably but little knowledge of what the Mexican mines, and especially those situated in the Guanajuato district, have achieved. At Guanajuato the principal or "mother vein" has yielded the sum of $1,000,000,000 (one billion dollars), as sufficiently proved by the Mint and Government records. The chief mines situated on the mother vein (Veta Madre) include the famous

Valenciana, the Rayas, the Mellado, the Cata and the Sirena, etc. Of these the Valenciana has been the greatest silver producer, having to its credit the substantial sum of $300,000,000 and having been worked down to a depth of 2,400 feet on the incline. Taking the whole of these mines together, covering as they do an area of 10,000 feet on its strike, the output has been over $800,000,000, while the average depth worked within that course has been something less than 1,300 feet.

Perhaps no closer explanation of the output of silver from Mexico during recent times could be offered than by means of the diagram to be found elsewhere, for which I may say I am indebted to the courtesy of the Editor of *The Financial News* (of London, England), and for which great newspaper I have had the honor to act as Special Foreign Correspondent for nearly a fifth of a century.

It is only necessary to add that my illustration comprises seven main perpendicular divisions, each division including four years' total silver output, commencing with the period 1877-81 and ending with the period of four years 1902-5. At the margin on either side of the design a scale of million dollars is seen, rising from zero, by equal divisions of $25,000,000, to a total of $350,000,000 at the summit.

The total output for each period of four years having been computed from official figures, vertical black columns, corresponding by their varying heights to the amount for each period, appear in each division, and in juxtaposition with the scale in the margin. It will be seen from the total figures given of the production of silver during the four years 1877-81 on the diagram,

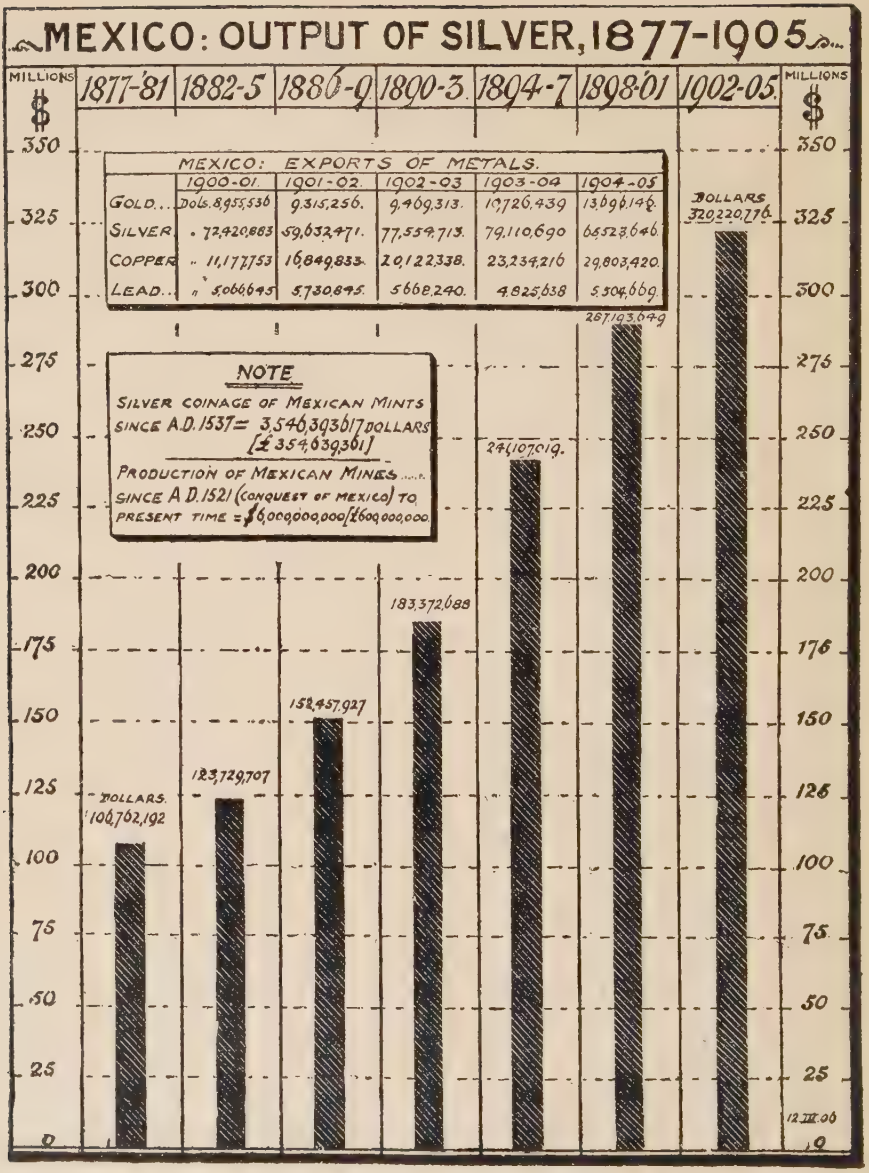

MEXICO: OUTPUT OF SILVER, 1877-1905
MILLIONS $
1877-'81
1882-5
1886-9
1890-3
1894-7
1898-01
1902-05
MILLIONS $
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
MEXICO: EXPORTS OF METALS.
1900-01. 1901-02. 1902-03 1903-04 1904-05
GOLD... Dols. 8,955,536 9,315,256. 9,469,313. 10,726,439 13,096,148.
SILVER " 72,420,883 59,632,471. 77,559,713. 79,110,690 66,523,646.
COPPER " 11,177,753 16,849,833. 20,122,338. 23,234,216 29,803,420.
LEAD.. " 5,066,645 5,730,845. 5,668,240. 4,825,638 5,504,669.
NOTE
SILVER COINAGE OF MEXICAN MINTS SINCE A.D. 1537 = 3,546,303,617 DOLLARS [£ 354,639,361]
PRODUCTION OF MEXICAN MINES ..... SINCE A.D. 1521 (CONQUEST OF MEXICO) TO PRESENT TIME = $6,000,000,000 [£600,000,000]
DOLLARS 106,762,192
123,729,707
152,457,927
183,372,688
241,107,019.
287,193,649
DOLLARS 320,220,776
12.III.06

Plate 2.]

that, compared with that stated for the last four years (1902-5), the output has increased by no less a sum than $213,458,584 Mex. (approximately, £21,346,000, or an increase of 200 per cent. in twenty-eight years.

The "inset" tabulation of the Mexican exports of metals from 1900-1 to 1904-5 (shown in the chart) would appear to explain itself. The following compilation, however, of the percentages of increase and decrease under the head of each metal for the two periods 1900-1 and 1904-5 may be instructive:—

Metal.	Exports. 1900-1901.	Exports. 1904-1905.	Percentage. Inc. or Dec.
Gold ...	$8,955,536 ..	$13,696,146 ..	+ 52.9
Silver* .	72,420,883 ..	65,523,646 ..	— 9.5
Copper .	11,177,753 ..	29,803,420 ..	+166.6
Lead ...	5,066,645 ..	5,504,669 ..	+ 8.6

Readers of these pages will be able to follow the histories, many full of romance, of the several properties and glean also some idea of what may yet become of them; for the whole of the Guanajuato Camp is undergoing a gradual transformation, and many of the long neglected properties are finding new owners possessed of ample funds to put them once more upon a profit-earning basis, as well as importing into the management all the enterprise, judgment and ability which nowadays characterize the Anglo-Saxon mining profession. It is only fit and proper that a mining district pos-

* The exportation of silver dollars has practically ceased, silver being now exported in the form of bullion at market value.

sessed of such a remarkable record as that of Guanajuato, and providing, as I believe it will, so fine a field for future developments, should have a volume—however modest be its pretensions—devoted entirely to its consideration.

THE AUTHOR.

GUANAJUATO, MEXICO, June, 1906.

Chapter I.

Early Days in Guanajuato.—First Workings and Discovery of the Mother Lode.—Some Remarkable Prophecies.—Fortunes Realised.—De La Borde, Antonio Obregon and Sardaneta.—Guanajuato Described.—The Origin of Its Name.—"Hill of the Frogs."—Hidalgo and Guanajuato.—The Carcel and Its Inmates.—The Panteon.—Some Spanish Architecture.—Places of Interest and Note.—A Town of Fine Residences.—Social Life in Guanajuato.—The Inhabitants and Their Recreations.—The Reservoir.—The Tramways.—Cost of Living.—Railway Improvements.

GUANAJUATO, the capital of the state of the same name, became a city in 1741, and even at that time possessed a population of some 80,000 souls. Long before then, however, the Spaniards had commenced mining in the district, the first shaft in the Mellado mine having been actually opened by them on April 15, 1558, and that of the Rayas mine on April 16, 1558. Previously to that, even, a silver discovery had been made at San Bernabe, at La Luz, but it took a period of nine years for the early pioneers to discover that there existed such a thing as a Mother Lode. At the point where this discovery was made the ore was mined to a width of 100 feet, while the sinking of the Mellado shaft, above referred to, proved the continuity of the vein northward and mining speedily spread along both sides of the lode, the workings at about this period being from Tepayac to Sirena.

The district has never lacked enthusiastic recommendation, and probably no mining camp in the world has ever more deserved it. Cortes sang its praises, even

imperilling his own interests by so doing, since the greedy King of Spain demanded his "tithe" upon every dollar's worth of gold and silver extracted, and had a nasty way of showing that he meant to have it. Humboldt proclaimed its value from the housetops, and a consequence of his eminent advocacy was that a stream of men, entirely unfitted for or experienced in mining in any country, and especially one like Mexico in those troublous days, came out from all parts of Europe and succeeded in doing an injury both to themselves and to the country which they afflicted. In later days prominent mining experts like Mr. John Hays Hammond have pronounced unhesitatingly in favor of Guanajuato camp, this gentleman, with a world-wide experience to guide him, having declared his belief that "the district of Guanajuato is the most thoroughly mineralized zone in the known world for gold and silver." Even from the grave comes additional testimony to Mexico's remarkable richness, for on one memorable occasion now recalled with interest—"for he who is dead yet speaketh" —Cecil Rhodes expressed his firm conviction in the future greatness of this richly endowed country. "It is my opinion," said the distinguished Empire-Builder, "that the richest mining countries in the world are Mexico, Peru and Bolivia, especially Mexico. I am not blind to the unison of opinion as expressed by scientists and experts that Mexico will one day furnish the gold, silver, copper of the world; that from her hidden vaults, her subterranean treasure-houses, will come the gold, silver, copper and precious stones that will build the empires of to-morrow and make future cities of this world veritable New Jerusalems."

There are stories more or less common gossip to-day among the Mexican peons of vast fortunes taken out of some Mexican mines, one evidence of which is to be found not alone in the magnificent residences which the lucky owners built for themselves out of the proceeds, but in the form of handsome churches and chapels which they piously constructed and richly endowed as a thank-offering. There was the colossally rich Joseph de la Borde, a Frenchman who, in 1743, won $18,000,000 out of the Cañada mine, and again, in 1762, took $12,000,000 out of the Tasco mine. One Jose Sardaneta extracted $11,000,000 from the Rayas mine, and Antonio Obregon was half-owner of another property which yielded to its fortunate proprietors a trifle of $226,000,000! "What has been, may be again."

The City of Guanajuato is practically enclosed by the high precipitous mountains which surround it, the principal entrance being through the Cañada de Marfil. This cañada terminates southward in the lofty and steep "Bufa," a mountain crowned with curious-looking rocks, about 1,050 feet high, measured from the bottom of the valley. On the loftiest of the northern slopes are located the celebrated Valenciana, Mellado and Rayas mines. Easterly and northeasterly, the Sirena Mountains rise about 1,200 feet, while southwesterly between Guanajuato and Marfil, the mountains become less rugged and considerably lower, sloping rapidly towards the city. From this eminence one can look down upon a portion of the town, but never at any time can one obtain a complete view of the whole place, winding a little, as it does, and nestling deep down in the shade of the cañon.

The low hills afford from the southwest a splendid perspective of the plains of Celaya and Salamanca. The surrounding heights are practically bare of timber now, although at one time it is believed they were well covered with American oak, which grows well here. Most of the available timber was cut down by both sides during the War of Independence, while in the early days of the Republic no steps were adopted to prevent further destruction, and no new trees were planted. The heights to-day are only overgrown with low but thick scrub, and various kinds of cactus. On the other hand, near by there are some good plantations of mezquite, or iron-wood, which is valuable for the mines and building purposes also. An unlimited amount of broken rock and stones, almost every size, is found ready to hand, and is largely utilized, for constructing small houses for the miners, while the loose soil is likewise used for *adobe* bricks, made much after the style in Egypt, the stuff hardening splendidly in the sun, and forming a very durable and substantial material for walls and flooring at practically no cost but that of the labor itself.

How the City of Guanajuato, like the State itself, derived its name no one knows, although the guide-book editor and the local *quidnunc* will glibly tell you all about it. What is certain, however, is that while the modern spelling of the word is as written above, the actual pronunciation is entirely different, being as nearly as possible thus: *"Wan-ah-wah-to."* The word is evidently Tarascan or Otomite in origin, or even, perhaps, Toltec. Handed down, as it has been, by Spanish translators from generation to generation, both the precise pronunciation and the original significance

have been lost. It is said that the ancient Tarascan Indians called the place the "Hill of Frogs." This, however, is the merest conjecture, and certainly there is nothing about the formation of the country to warrant the description of a "frog" being applied to it more than that of any other animal, while it is obvious that the name could not apply to the whole surrounding country even if it related to any particular portion of it. Furthermore, there are but few frogs or animals of the same species found in the neighborhood which would account in any way for the designation now commonly attributed to the country.

Among the cave-dwellings and rocks found among the ancient remains of Guanajuato have been discovered certain stone-figures, doubtless deities among the ancient Indians, and which, to the highly imaginative eye, may resemble frogs. This fact is seized upon as evidence to prove the derivation of the title "Hill of Frogs"; but, on the other hand, other stone images of other strange animals have been found in the same places, so that this explanation is only partially acceptable after all.

If this were a guide-book, much could be written about the attractions of Guanajuato City as a tourist center but it is not such a publication, nor has it indeed any ambition to be so considered; while, as has been previously pointed out, Guanajuato does not lie upon the beaten track of tourists coming to Mexico, yet several stray specimens of that wandering class occasionally find their way there.

Nevertheless the city is replete with interesting sights and memories, inseparable, indeed, from the history of

the Republic itself. For instance, the State prison, a conspicuous object, situated in the very centre of the town, is alone worth a visit to Guanajuato to see and hear about. Originally this place was built as a Chamber of Commerce, and in 1785 was dedicated to the peaceful uses of trade and industry. The Alhondiga, or Castillo de Granaditas, is a perfectly square, flat-roofed, solid-looking building, not in the least suggestive of anything else but what it is—a gaol.

The prison régime in Mexico certainly does not err upon the side of harshness, if one may judge from the lenient manner in which prisoners of the Carcel at Guanajuato are treated. The building itself is not particularly gloomy except from the outside, the interior being formed of the usual "patio," with different departments, devoted to various trades followed by the prisoners, opening off it. The centre of the patio is occupied by a large square basin of water, wherein the prisoners are compelled to bathe and indulge in what, to the most of them, at least, must be the novelty of a cold shower. The sleeping accommodation is cleanly and healthful, but not precisely luxurious. The food which is given is wholesome and plentiful, but not especially appetising. The prisoners are allowed perfect freedom in walking about the building and even mounting to the flat roof and there viewing the city lying beneath them. Probably some of the inmates of the Carcel are better off where they are than they would be in wretched hovels which some of them know as "home." Some of the very long-sentenced men, who are held for murder or some other serious offence, are sent out daily to work on the roads or new public buildings, and they are not dis-

His Excellency General Don Porfirio Diaz.

President of the Republic of Mexico.

Plate 3.]

pleased at the privilege, either. After all, their forced labor is not very unlike their customary voluntary service, and the food they receive is somewhat better.

The rebellious priest, Hidalgo, whose history forms one of the most striking examples of heroism, and whose end was that of most patriots who were born "a little too soon,"—a painful and humiliating death, took this apparently impregnable stronghold in the early part of the uprising against the Spanish domination. Hidalgo, however, was himself captured later at Chihuahua, and, having been held in prison there, was brought to Guanajuato, and, in company with other patriotic but unsuccessful leaders—Allende, Aldama, and Jimenez—was executed in this prison, the heads being suspended by the hair on iron hooks at its four corners. To-day, handsome marble tablets, inscribed in gigantic letters of gold with the names of the four sufferers, occupy the places where the hooks with their gastly burdens were previously placed.

The legend connected with the taking of this prison says that Hidalgo called for a volunteer from among his followers to come forth and set fire to the building's massive doors. Immediately an enthusiastic Mexican peon presented himself—there was no lack of heroes in those inspiriting times—and, binding a huge square slab of paving stone on his broad back, doubtless to ward-off the shots and pieces of rock hurled down upon him from the roof of the building by its defenders, he actually succeeded in accomplishing his object. The name of this "peon-patriot" has been lost in obscurity, but a stone statue representing the unknown hero with the stone bound to his back and a flaming torch in his

hand has been erected to his memory and reposes in the interior of the Carcel, well protected by heavy iron railings. It bears no inscription, since the name of the individual is no longer known. To this day, however, the stray visitor is shown some deep and no doubt perfectly genuine crimson stains on the heavy stone pillars of the principal stair-case, which are declared to be the veritable blood of the victims who fell in the taking of the Alhondiga. There is probably a great deal more foundation for this belief than for most other narratives of a similar nature. Certainly the events narrated are of comparatively recent occurrence, and it is not merely a question of—*"si non e verro, e ben trovato."*

For those who revel in the weird and the gruesome, there is the Panteon, which strongly reminds one of the catacombs at San Calixto at Rome or those at Paris. The vaults contain some hundreds of skeletons of dead and almost forgotten human beings, who once peacefully reposed in decent Christian graves, but who, owing to the reluctance or inability of their surviving relatives to pay the rent, have been ignominiously evicted, and now stand in their serried ranks in this gloomy charnel-house, awaiting final dissolution. It seems that the lease of an ordinary tomb, or a receptacle in the wall, is for five years. If, at the end of that time, no renewal is arranged for, the poor body is turned out and takes its place, as I have said, side by side with other evicted corpses. Here they may be inspected by means of a special permit from the Government authorities. Formerly the skeletons remained absolutely uncovered; but, owing to the propensity of visitors for stealing the poor things' bones, and perhaps also from a latent mo-

tive of decency, white sheets now hang from the necks downwards, concealing from view all but the grinning skulls and the lower parts of the legs. It would not be amiss were the authorities to proceed a little further and close this part of the Panteon altogether.

In Guanajuato may be seen some of the very finest of the many fine specimens of ancient Spanish architecture, especially among the numerous Churches, of which nearly every famous mine still possesses a magnificent specimen. The style in Mexico is something between Aztec and Spanish, and yet wholly characteristic of neither. The main and most interesting features are the patio and the Moorish domes, arches and towers. The patio is admittedly Aztec in origin, although the Spaniards also employed it in their houses, if not in precisely the same form or for the same purposes. The splendid arches to be found throughout Mexico, and some beautiful specimens of which are met with supporting prosaic hacienda walls in Guanajuato, are distinctly Spanish. Even the most ordinary architecture is improved by such artistic additions. The great Moorish domes and elaborately carved fronts on some of the Churches, such as those at the Valenciana mine and the one facing the Bustos Mill at Guanajuato, are particularly fine; and it is to be hoped that Guanajuato people will treasure these relics of the past carefully and as a trust, not allowing the "improving" hand of the builder to touch even as much as a stone or a crack of them.

I have visited a dozen little places, both large and small, in Italy, Sicily and some parts of Spain which remind me forcibly of Guanajuato, more especially since the awful visitation of July, 1905, when, as the result of

a cloud-burst in the hills, a large portion of the centre of the town was reduced to ruins, the results of which calamity are, however, fast disappearing. But there all resemblance ceases. Guanajuato is as clean and as trim as Italy and Sicily are slovenly and dirty; the people are as bright and as cheerful as the Italians and Spaniards are depressed and poverty-stricken. But the same glorious skies of cerulean blue spread above both, and the same brilliant green foliage is to be found in one and all these towns alike.

Guanajuato is a strange mixture and assimilation of the old and the new, of the picturesque and the strictly utilitarian. Side by side with a humble adobe dwelling, towers some handsome edifice surrounded by its beautiful gardens. It is difficult to convey an adequate idea of the beauty of the town's pride-building, the "Teatro Juarez," a structure which, to the sceptical observer, might appear almost too magnificent for the town which it adorns, and too capacious for the number of inhabitants which it contains. There is many a provincial town in England and France, to say nothing of the United States of America, which would be extremely and properly proud to own so stately a building as the "Teatro Juarez," which overlooks the Jardin de la Union, and completely dominates it. The design is of modern architecture and of the highly ornate style, the exterior being built of the beautiful green-stone found in the neighboring hills. Its superb portico is supported by a double row of six Ionic pillars, the portico itself being in two low tiers surmounted by a terraced balcony, with eight superb allegorical bronze figures. The supporting columns are constructed of discs of green-

stone, laid one upon another. The bronze lamps and their finely moulded supports, the broad and sweeping flights of stone steps leading up to the entrance hall, together with the handsome wrought iron-work of the railings and window balconies, are about as fine as one would see in a city of the greatest pretensions. If the exterior is magnificent the auditorium is no less so, being richly decorated, carved and upholstered. The theatre possesses one of the finest *foyers* that I have seen, almost as fine as that of the celebrated Opera-House at Paris, furnished in a sumptuous manner, and elaborately paved with semi-transparent glass tiles.

Another superb building is that of the Palace of Legislature, which was inaugurated by President Diaz in November, 1903. The edifice, however, was actually completed three years previous, at a cost of over $150,-000.00 Mex. The Architect was Louis Long, and the whole of the decorative painting was done by Claudio Molina and Nicolas Gonzalez. The structure is a three-story one of solid masonry, the ground floor of which is occupied by the revenue office and treasury. The halls of Congress are situated on the first floor, the Tribunals of Justice being on the second and the archives rooms on the third. The first story front rests on twelve slender, graceful columns, and four bronze and crystal electric light clusters stand in the angles of the courtyard. The Congress-hall is divided into two parts,—one being for the State deputies and the other for the Public. The walls are hung with oil paintings representing distinguished Mexicans, such as the patriot-priest Hidalgo, President Benito Juarez, President Porfirio Diaz, Cortazer, Abasolo, Aldama and Doblado. These pictures,

together with the furniture, cost over $100,000 Mex. Among other notable features of Guanajuato to-day may be mentioned the Esperanza Reservoir, the Electrical Power Plant, the Parque Porfirio Diaz, known as "El Cantador," and the Presa de la Olla. The State College, where a magnificent collection of mineral specimens has been got together, is also a notable addition to the possessions of this well-favored town.

Guanajuato is, moreover, singularly fortunate in the possession of a number of beautiful private residences, the great majority of which are conspicuous, not alone by the elegance of their architecture, but by the superb gardens which front and sometimes suround them. Owing to the curious conformation of the ground upon which the town of Guanajuato is built, viz: a deep ravine through which runs the erratic and broken course of the river-bed, some of the houses stand very high, while others are located on a much lower level, the gardens running up or down as the nature of the ground dictates. Every kind of sub-tropical plants and flowers are to be found in these beautiful gardens, which, viewed from a height, afford one the impression that Guanajuato is situated on one huge green oasis, nestling cosily in the hollow of the eternal hills which surround it. There is an air of delicious freedom and quietness about the place almost deceptive, since, especially of late months, it has become the centre of a considerable activity which promises to become more pronounced as the mines are more largely opened up. The Central Plaza or Jardin is a rendezvous for all "the rank, fashion and beauty" of Guanajuato at midday and at sunset when the day's work is finished. Here the Mexicans of the

lower class assemble, and in their motly attire and multi-colored blankets form as curious and amusing a gathering as one would meet with in a day's march. They are a quiet and well-behaved crowd, the only disturbing element being the noisy newspaper boys and itinerant vendors, who, here as elsewhere, proclaim their wares in strident accents suggestive of excellent lungs but little consideration for others who possess "nerves."

A very pleasant phase of Guanajuato's social life is the good feeling and bonhomie which exist between the various foreigners living there. Naturally the American element predominates, but there are a few Britishers and one or two Germans who provide the necessary levening element, the result being a decidedly agreeable little coterie all being upon excellent terms with one another and *au mieux* with the native official classes. The Guanajuato Club—or "Casino" as it is termed—is the rendezvous of all the "good fellows" of the town, and at almost any time of the evening or on a holiday one may be certain of meeting with some congenial companion. There is a technical society here also known as the "Saturday Night Club," where most of the leading mining men come into town and meet in informal conference. That the foreigners living in and around Guanajuato are very popular with the Mexicans is an undoubted fact. They are few in number but very influential, and no act of charity or to the public advantage is ever allowed by them to escape their attention and active co-operation. Moreover, both the Americans and the Englishmen are good to their own people and to one another, as numerous deeds of kindness and generosity, of which I have personal knowledge, testify. Altogether Guanajuato

may be termed a very desirable place in which to live, as much by reason of its social attraction as its magnificent climate, picturesque surroundings and splendid business opportunities. Undoubtedly the city to-day contains some of the brightest and most accomplished men in the mining and engineering profession, men of whom the scientific and commercial world are destined to hear a very great deal more in the future.

Finally, in Guanajuato they are a cheery lot of men and kind, hospitable women, who live up to the creed of Ovid, lover of good things. *"Et res non semper, spes mihi semper adest."*

Apart altogether from its great interest as a mining centre, Guanajuato must always hold great historical value as the place where Hidalgo won his greatest success, and which, indeed, became his headquarters. In his day the city was considered one of the richest and most important in the country, and although after the several revolutions which followed the severance from Spain, Guanajuato fell somewhat from its lofty estate, it is at the present time fast regaining its former importance and even adding to it. British and American capital is coming in more rapidly and with greater results than in any other part of the Republic. Almost every street and many of the houses in Guanajuato speak yet of Hidalgo and his conquering followers, for things outwardly, at least, have changed very little in the city. It was on the 13th of September, in 1810, that Hidalgo commenced his revolt against Spain and the rapidity with which he collected his followers around him was not the least remarkable feature of his short but successful campaign. It is said that his army was got together in

Guanajuato: A Typical Street in the Peon Quarter of the City.

Plate 4.]

the space of 24 hours, and just before coming to Guanajuato he captured two other towns, San Felipé and San Miquel el Grande, seizing all the foreigners' property and destroying their houses, a similar policy being pursued in Guanajuato itself. Here had been gathered together an immense amount of valuable treasure, since the Spaniards had brought in all their hoards of gold, silver, quicksilver and family jewels, thinking that in the Alhondiga, strongly fortified as it was and under the protection of the Intendant himself, they were perfectly safe. But the victorious Hidalgo not only took the Alhondiga and killed the Intendant and the Spaniards, but appropriated the whole of their accumulated treasure and found it extremely useful for maintaining his army of patriotic assassins, and keeping them in good humor.

The Guanajuato Tramways Company runs a local service with three branches as follows: The main line from Marfil to Guanajuato, serving the city and the residential portion as far as La Presa, that being the terminus; a branch line to Pastita, and a second branch to Bustos. The traction is by means of mules, it being contemplated to change the power to electricity, however, at some later date.

The water supply of the city is both ample in quantity and excellent in quality. The watershed is situated high up in the surrounding mountains, and is actively patrolled by police for the purpose of preventing any fouling or tampering with the supply. La Esperanza dam is a magnificent piece of work, and reflects as much credit upon the constructors as it does upon the enterprise of the town in building it.

The telephone service is at present confined to private installations, but a Company has been formed to introduce a public service upon the most approved principles, and which will connect Guanajuato with Mexico City.

Living in Guanajuato, if considered in all its aspects, is certainly not expensive, and compares favorably with the prices paid in other cities. House rents are, however, continually augmenting; but this may be explained by the fact that the foreign resident population is continually increasing; houses with fine gardens which formerly let for $25 Mex. (say £2/10) a month, now fetch $100 Mex. (£10) a month, and accommodation is extremely difficult to obtain. The hotels, of which there are but three in the city of any consequence, are at present unable to accommodate all the guests.

Even to the visitor who is "no miner," a walk around a Guanajuato mine must inevitably prove of great interest, and indeed a source of some wonderment also. Whether one pauses at the outset to watch the busy, hurrying throngs below—men, women and children hastening here, there and everywhere, climbing up the winding road or stumbling down the path from the main entrance, reminding the spectator strongly of "Jacob's Ladder" and its angel hosts; whether one examines the huge mounds of as yet untreated ore; measures with the eye the huge excavations along the outcrop of the principal vein—some with a breadth of something like 200 ft. between walls and 40 ft. deep; enters the gigantic cavernous stope, which has a width of 20 ft., a height of 300 ft. and a length of 300 ft.; or lingers above ground to admire the beautiful panorama of open country and stretches of rolling mountains for hundreds

of miles—the experience is both a novel and a delightful one in the extreme.

One can indulge uninterruptedly in day-dreams, if one is that way inclined, for the neighborhood is strongly suggestive of romance and stirring tradition, conjuring up visions of the ancient Indians, with their fire and water appliances, toiling for the silver contained in the rocks; picture heroic Hidalgo himself with his 20,000 followers announcing "the independence of Mexico," and being joined by the inhabitants marching triumphantly into Guanajuato and satisfying their feelings by levelling every important residence in the place. But those days of strife and turmoil, of revolution and counter revolution, have forever—let us hope—disappeared, and only peaceful toil "— humble toil and heavenward duty, these that form the perfect man—" now disturbs the quietude of nature. Here for hundreds of years men have wrestled with the hard, unyielding rocks for their concealed treasure; and here, for many more years to come, will man's latest mechanical devices wring from the reluctant earth every single grain of precious metal that remains uncollected.

The only drawback to the complete success of the City of Guanajuato as a place of residence, namely, the absence of direct railway connection, is shortly to be removed, and probably by the end of the current year the long devised and much wanted plans for the Central Railway line direct into the city, will have been consummated. The right of way through the long route from Marfil to Guanajuato, about four miles and at present traversed by a primitive mule tramway, has been secured and the construction of the extension is to be com-

menced immediately. The San Gregorio branch railway, which at present also terminates at Marfil, is to be provided with a station in the City of Guanajuato likewise and this will afford connection with the National Railway at Salamanca. This new railway accommodation means an immense deal for the mining interests, which are at present somewhat adversely affected by the inadequate arrangements for bringing in supplies and machinery.

Chapter II.

The State of Guanajuato.—Curious Topographical Features.—Mountains.—Rivers.—Climate and Rainy Season.—Spring-Time in Mexico.—The Flood of July, 1905.—Flowers.—Fruits.—Mining and Agriculture.—Some Experiences.—Ward and His Opinions.—The Industries of Guanajuato.—Remarkable Annual Output.—How the State is Divided.—Towns and Populations.—Railway Locomotion.—Posts, Telegraphs, &c.

NATURE has been bountiful in her dealings with Guanajuato and, in comparison with some parts of the Republic of Mexico, it is assuredly one of the most favored in position of climate and mineral richness. Its immense natural deposits of gold and silver are now world-famed, and, indeed, have been so for many hundreds of years. Its fertile lands, populous cities, thriving population and well-equipped railroads make the State of Guanajuato one of the choicest of the 27 States forming the United States of Mexico.

As neighbors, Guanajuato has the flourishing State of San Luis Potosi on the North, and Michoacán, with the celebrated Dos Estrellas and Esperanza mines, on the South; beautiful Jalisco on the West and the quaint Querétaro on the East,—a constellation of natural scenic attractiveness hard to beat.

The traveller viewing this portion of the country for the first time, cannot but be struck with its curious topographical aspect, unlike in many respects that of any other part of Mexico. The situation of the land is on the cordillera of the Anahuac. The Northwest and Cen-

tral sections are traversed by mountainous ranges, while to the west and south extend the wonderfully rich valleys on San Felipé, San Judas and Santiago, as well as the beautiful fertile plain of the El Bajio. Here may be seen the heights of the Sierra Gorda to the Northeast, and those of the Sierra de Guanajuato in the centre,—the Cordonices, San Antonio and Santa Rosa ranges all forming a junction at this point. Into the exquisite turquoise heavens rises the summit of the "Gigante" (the Giant), some 2,346 meters high, and looking quite conspicuous in its solitary grandeur. It is, however, not the highest peak in the Guanajuato mountains, for the beautiful Llanitos is some 2,815 meters high. These mountains are soothing to the eye rather than magnificent, and serve to fill in the frame work of the picture, bestowing upon it that completeness which Nature alone can supply. There are several smaller ranges extending in apparently endless tiers away to the horizon, presenting a soft, velvety appearance in the sun-light, such as an artist would give his soul to be able to depict upon canvas.

What makes the Guanajuato State and District particularly valuable both from an agricultural and a mining point of view, is the abundance of water which Nature has lavishly provided, yet with a careful and discriminating hand. Of the several rivers which course through this portion of the country and water the state almost from end to end, are the Lerma, the Laja and the Turbio. The two latter are, as a matter of fact, tributaries to the first named, but of sufficient importance in themselves to warrant a separate and distinct nomination.

The Lerma rises in the State of Mexico, crosses the State of Guanajuato for a distance of about 147 kilometers, and then loses itself in the Pacific Ocean near San Blas, in the Territory of Tepic. Its affluent, the Laja, commences its career in the mountains of the Sierra de Guanajuato, and, after receiving the tributes of other streams and running a course of a 126 kilometers, throws itself into the receptive arms of its mother Lerma.

The Turbio is sometimes known under the name of Gomez, and, rising away in the mountains, meanders through some 113 kilometers of country, eventually reaching the Lerma and there emptying itself.

Besides these three rivers, the State of Guanajuato possesses the Irapuato, a small but useful stream, and the Yuririapundaro, or "lake of blood," about 97 square kilometers in extent, and dotted with several little islands. A large natural well, believed by some to be the crater of an extinct or at least a quiescent volcano is more interesting than valuable. It is called the Albecas, but its precise depth has never been successfully gauged.

Next to its splendid water supply, Guanajuato may be congratulated upon its superb climate. Assuredly, but few climates exist which are more delightful. Unless one climbs up into the mountains during the winter and rainy season, when it is apt to be cold and damp, the climate is perfectly charming, being seldom too hot and as seldom too cold, although this year (1906) the inhabitants may have had some reason to complain of the sharp frost which visited them and did material damage

to their growing crops and flower-gardens, as well as causing them personally to regret the insufficiency of their attire. This, however, is very exceptional, the mean temperature being about 21 degrees C. (say 70 degrees Fahrenheit), and the highest 28 degrees C. (say 82.40 degrees Fahrenheit) during the hot months of the year.

When it rains in Guanajuato—it rains! There is no doubt about that, nor is it all necessary or usual to inquire "whether it is raining?" The water comes down in buckets; but, severe as it is while it lasts, the sky soon clears, and the glorious sun again comes forth to warm the grateful earth. Although it has been known to rain for as long as from two or three days without cessation, the duration of the showers usually fails to exceed two or three hours at a time. The rains commence about the middle of July, and continue till the beginning of October. The wind comes from the Northeast, changing to Southeast as the rainy season approaches.

Guanajuato has had its good times and its bad, its ups and its downs, its fortunes and its misfortunes. It has borne the one as stoically as the other, and although once visited with a misfortune which would have caused any ordinary town of its kind to bend and break under the affliction, Guanajuato shook itself bravely and at once commenced to restore its shattered condition.

At times of Revolution the town had suffered badly. In the years when the Revolutionary troops vied with those of the Government side in purposeless destruction, and again when Hidalgo made a brave but fruitless attempt to free his country and found Guanajuato among the first to welcome him and his cause, Guana-

GUANAJUATO: A PEON STANDING AT THE DOOR OF HIS HOUSE.

Plate 5.]

[See page 24.

juato suffered. But by far the greatest blow endured was that which fell on the 1st July, 1905, ever to be remembered among the people as *un jour de malheur.*

The sum total of this misfortune was a loss of 200 human lives, the wrecking of 400 houses, the irreparable loss of valuable property such as the fine libraries of the Governor, of many private individuals and of State archives, and a financial damage to the amount of $3,000,000, say, £300,000. It must stand as an everlasting tribute to the pluck, energy and patriotism of the people that in the short space of 48 hours after the accident had occurred, money, food and clothing poured into the stricken town, and not a soul seeking help was denied. The magnificent response of Guanajuato's own citizens stood out boldly from among a list of liberal donators, and the same spirt of loyalty and generosity has ever been displayed by the Guanajuato people whenever they have been called upon.

The situation of Guanajuato is unfortunate in some respects, but delightfully picturesque as I have said, and as my panoramic photographs will show. In a mountainous region like this, the storm clouds naturally find considerable attraction and the fall of rain is extremely heavy while it lasts. It was a cloudburst just over the town of Guanajuato that caused the misfortune primarily. At the very highest portion of the town is the fine reservoir and dam known as La Olla, and at first the inhabitants believed that it was this which had given way and was emptying the city's water supply recklessly through the streets. But although the dam and its masonry walls did not escape damage, they held together. The deluge proceeded from the mountains

themselves, and rushing down the steep street of the town simply washed everything before it—substantial buildings, trees, walls and the luckless people. Although the great calamity occurred at an hour in the afternoon, it had been raining heavily for some days previous. Other inundations had been known, but none like this. The town was more than usually full of people, many having come in from the country round about to witness the ceremonies held in connection with the emptying of the La Olla reservoir for cleansing purposes. The Presa de la Olla was gay with booths and brightly attired peons. Then down came the irresistible rush of waters, in which hundreds of people were swept away like whisps of straw, some to be saved, others to be carried, drowned or battered to death, into the Guanajuato River, or to lie jammed under fallen houses and crumbled walls. Some of the bodies were recovered as far away as Marfil, four miles from Guanajuato, where the Central Railway's line, connecting with Silao and the main system, was almost washed away. Although much of the damage has since been repaired, the eleven months are not sufficiently long to restore what the flood of a single hour laid to waste. In an almost incredibly short space of time the waters had come down on the devoted town, reduced it to practical ruin and then disappeared. To-day the crumbling walls and huge gaps between the houses, the broken-up appearance of some of the surrounding walls and the damp condition of fully one-half of the houses in the town itself, testify to the trial which the inhabitants had to go through, a trial borne with the most exemplary patience and resignation. Fortunately the

splendid public buildings like the "Teatro Juarez," the Legislative Chambers and the Governor's Palace, did not suffer heavily, the first named escaping almost entirely owing to the elevated position which it occupies.

That any recurrence of the disaster referred to, in connection with the Guanajuato flood of July, 1905, can take place, is unlikely in view of the determination arrived at to construct a tunnel running through the high ground about the city, which will carry off all the surplus water which may accumulate from either a cloudburst or protracted rains in the immediate neighborhood. The State Engineer's plans have been passed, and the contract for constructing the tunnel has been awarded. The tunnel will be 1,300 meters long, by 7½ meters in diameter. Most of the work will be through solid rock, and it will occupy at least 12 months to complete it. The contract is in the hands of the Mexican Construction and Engineering Co., of Mexico City, who have already made a commencement.

It would be difficult to find in the whole of Mexico a prettier stretch of country than that surrounding the the City of Guanajuato, especially during the Spring months of March and April. Then the whole aspect of the land, as in the United States and Great Britain, undergoes a complete change of colour; the dull browns of Winter giving place to the most exquisite tints of green, ranging in hue from the palest lettuce to the darkest sage, and with the delicate mauves, dark purples and sienna browns of the mountain ranges, combined with the opalescence of the sky (which does not change from day to day in its purity and denseness), all make up a color-scheme which no eye could fail to admire.

Spring-time in Mexico is the loveliest period of the year, and seldom demonstrates that fickleness that characterizes an English Spring, or brings disaster to the farmer and despair to the sportsman. It is very rarely that the seasons in Mexico are disappointing in their results, or uncertain in their times of arrival.

The flowers in Mexico are unrivalled in any part of the world, and I speak from a wide experience, having travelled around the globe some four times, and having visited every part of it. The rich coloring and the intoxicating perfume of the Mexican *flora* form a continual delight to those who have never seen or inhaled them before. Here, one is attracted by the enticing but somewhat too powerful odor of the flowering orange-tree, as much as by the brilliant green of its surrounding foliage. Of roses there are countless varieties, as of lilies; while camelias, heliotrope, bourganvillers, clematis, iris, hydrangea and innumerable other kinds of flowers which delight the eye and regale the nostrils, may be found in almost wild profusion.

The number and character of the trees are, perhaps, little less remarkable. Near the City of Guanajuato one may find hundreds of beautiful well-grown oaks, blue-gum, and other similar trees. One particularly fine forest of well-developed oaks is located upon a ranch belonging to the Guanajuato Development Company, and of which I give somewhat fuller details in another part of this volume. In the State of Guanajuato there may be found some twenty-three different species of timber, valuable alike for building purposes, timbering of mines, and fuel. Besides the oaks to which I have referred, pine, fir, cedar, mahogany, rose-

wood, iron-wood and a dozen different kinds of other woods grow.

Fruits of numerous kinds abound in the State, the climate lending itself peculiarly to its successful cultivation. There are some forty or fifty different kinds of fruits grown here, while, in regard to other useful plants, shrubs and trees, I may mention some thirty-two textile and eleven tanning plants; fifteen oleaginous plants; sixteen dye-woods; about eighty medicinal plants; twelve forage plants; eighteen aromatic plants; fifteen gums and resins, etc., etc.

Naturally in a country so well served with water and having so fine and productive a soil, agriculture finds an encouraging field for development. I regard this factor as one of singular value to the mining interests, since I have always held the opinion that where agriculture and mining can march hand-in-hand it is of vast importance to allow them to do so, and to encourage their association in every legitimate manner. The one helps the other, and however much fanatics may assert that "the lust for gold" destroys all ambition to succeed in the more poorly paid pursuit of simple husbandry, I am prepared to prove, if necessary, that where, as in some parts of South Africa and New Zealand, mining has proceeded side-by-side with agriculture, the benefits arising for all classes of the community have been unmistakable.

It is stated by no less an authority than Mr. H. G. Ward, at one time the British chargé d'affaires in Mexico, and the author of one of the most fascinating and informative works upon that country, that, without mining as an assistance, agriculture would be confined

to such a supply of the necessaries of life as each individual would have it in his heart to raise; districts, formerly among the richest in the known world, would be thrown forever out of cultivation; the great mining towns would become, without agriculture as an aid, what they were during the worst years of the Revolution; and the country would be so far thrown back in the career of civilization that the majority of its inhabitants would be compelled to lead a Nomadic life, and seek a precarious subsistence among their flocks and herds, like the Gaucho of the Pampas.

So sensibly does Mr. Ward write of the close association between agriculture and mining that I feel impelled to quote from such an authority the few lines which run as follows: "I desire no better proof than that existing between the degraded situation of the husbandman or small landed-proprietor of New Spain (Mexico) in any district without an outlet, and that of a proprietor, however small, in the vicinity of the mines. The one is without wants, and almost without an idea of civilized life; clothed in a leather dress, or in the coarsest kind of home-made woollen manufacture, living in primitive simplicity, perhaps, but in primitive ignorance and brutality, too; sunk in sloth, and incapable of exertion, unless stimulated by some momentary excitement: while the other acquires wants daily, with the means of gratifying them; and grows industrious in proportion as the advantages which he derives from the fruits of his labor increase; his mind opens to the advantages of European arts; he seeks for his offspring, at least, that education which had been denied to himself; and becomes gradually, with a taste for the

delights of civilization, a more important member, himself, of the civilized world. Who can see this, as I have seen it, without feeling, as I have felt, the importance, not only to Mexico, but to Europe of a branch of industry capable of producing such beneficial effects? And *alone* capable of producing them; for Mexico without her mines, notwithstanding the fertility of her soil, and the vast amount of her former agricultural produce, can never rise to any importance in the scale of Nations."

This was written in 1827, eighty years ago; but although at that time the home-manufactures of Mexico and her consequent prosperity had not attained anything like the dimensions which they have reached today, Mr. Ward's summing-up of the situation was exceedingly accurate, and what he wrote is as true now as it was then.

From my own experience I should say that not only is labor attracted to a locality where work both above-ground and below-ground is plentiful and well-paid, but as often as not the miners themselves are induced to remain in a district by the fact that their wives and children, where the latter are not also employed on the mines, as is the case in the Guanajuato district and in other parts of Mexico, are perhaps enabled to carry on a little agriculture as an additional and welcome source of income, while the thriving mining community provides the best kind of market for the produce raised.

So far as one can trace the history of latter-day mining in Mexico—that is to say, subsequent to the declaration of Independence—there is no question that in every place where mining was conducted a demand

was created for every kind of agricultural produce, which rose as the importance of the mines increased, and called gradually into existence a cultivation of which no trace was to be found before. Such was the progress of civilization and of agricultural industry throughout Mexico.

Ward, to whom I have previously referred, declares that with the exception of the capital, which, as the seat of Government, derived its importance from other sources, and the towns of Puebla, Guadalajara, Morelia and Oaxaca, which were selected as the seats of the great episcopal establishments of the country, there was hardly a single town in Mexico that did not derive its origin directly or indirectly from the mines. From the enormous quantities of mules and horses employed in mining operations (14,000 were in daily use in Guanajuato alone) a rise in the price of maize occasioned an immediate reduction in all of the mining establishments.

I know that mining in the opinions of some individuals, no doubt perfectly conscientious and well-meaning, is "iniquitous"; and Lord Burleigh, the wise old Chancellor of Queen Elizabeth, strongly counselled men to depart from that "ungodly way of becoming rich by digging in the earth" and to betake themselves to cultivating it instead. But as I have attempted to prove, it is quite possible to pursue the occupations of mining and agriculture in the same district and at the same time, provided Nature has, as in the case of many of the mining districts in Mexico, generously supplied the means. In Guanajuato many promising agricultural tracts of country exist, and with the increase in the mining activity now to be observed on all sides, the fresh

GUANAJUATO: THE STATE PRISON, KNOWN AS EL CARCEL.

[See page 20.

Plate 6.]

arrivals which this activity is attracting day by day, and the greatly augmented wealth of the whole population, agriculture can, and no doubt will, be vigorously prosecuted, being bound to meet with practical encouragement from all the big mining corporations in the neighborhood.

It must not, however, be assumed that mining is the *summum bonum* of the whole country, or that it is the only industry which is pursued by the inhabitants. The fame of the Guanajuato mines, which has succeeded in reaching to the extremities of the earth, one might suppose had to some extent over-shadowed the several important trades of which the State can boast. It would be no exaggeration to say that Guanajuato is the most prosperous mercantile centre of the Republic. The two big Mexican railways (the National and the Central) derive much of their valuable traffic from this portion of the country. The total value of the trade emanating from the State of Guanajuato may reasonably be put at some $67,000,000 U. S. Currency (or, say £13,400,000) per annum, which, for a population of a little over one million, is an excellent showing. The chief sources from which all this commercial industry is derived comprise, first and foremost, the minerals which go to Mexico, United States of America and Europe, and which represent at least $20,000,000 U. S. Cy. (£4,000,000); then agricultural and other products $10,000,000 (£2,000,000), most of which find their way to the home states; thirdly, exports of industrial products $2,000,000 U. S. Cy. (£400,000); again, imports from Mexico City, United States and Europe to the extent of $12,000,000 U. S. Cy.; about $3,000,000 (£600,000)

from other Mexican States, and the balance from purely local trade.

The principal exports, after minerals and agricultural produce, are live stock, cotton goods, etc.; while the imports comprise, from Mexico City, Europe and the United States, such commodities as groceries, ready-made clothing, textiles, hardware, drugs, arms and ammunition, hats, canned goods, agricultural and mining machinery and tools, etc., etc. There is a considerable proportion of inter-state commerce, comprising such articles as the inevitable pulque, mezcal, tequila, fruits, coffee, etc., etc.

In the State of Guanajuato there are to be found numerous important and prosperous industrial establishments. No fewer than 350 woollen mills exist, their annual output representing 90,000 pieces of cloth, and 45,000 yards of carpet and other fabrics of this kind, all of which sell very readily. There are 853 cotton mills, producing a respectable average of 200,500 pieces of cotton or "manta"; 46,000 pieces of comboyas; 550,000 rebozos; and 100,000 kilograms of twine. These busy factories themselves use over 815,000 kilograms of wool and 1,000,000 kilograms of cotton, in the raw state, yearly. There are in addition 72 flour mills (using both steam and hydraulic motive-power), which produce 15,000,000 kilograms of flour per annum, as well as linseed mills, harness and saddlery factories, potteries, powder-works, distilleries, tanneries, foundries, etc.

From all this it will be readily seen that, even were the mining industry to be completely eliminated from consideration, the State of Guanajuato would still remain one of the most prominent and important sections

of the Republic, a state of affairs which Mr. Ward and writers of his epoch could never have contemplated; but, taken in conjunction with the vastly promising industry of mining which to-day looms up more conspicuously than ever, the prosperity of Guanajuato may be said to be almost unequalled in the whole Republic of Mexico.

The State is split up into Divisions or Departments, of which there are five. These, again, are sub-divided into 32 Partidos, the Departments being:

Allende (with 4 partidos and 47,000 inhabitants);

Celaya (with 11 partidos and 46,500 inhabitants);

Sierra Gorda (with 3 partidos and 33,500 inhabitants);

Leon (with 4 partidos and 194,000 inhabitants);

The principal towns in the State may be summarized and located as follows:

Cities and Towns.	Department.
Allende	San Miguel Allende, Dolores Hidalgo.
Celaya	Celaya, Acámabaro, Apaséo, Salvatierra.
Guanajuato	Guanajuato, Cuitzéo de Abasolo, Irapuato, La Paz, Salamanca, Silao, Valle de Santiago.

Leon	Leon de Los Aldamas, San Francisco del Rincón.
Sierra Gorda	San Luis de la Paz, San José de Iturbide, Xichú, Santa Catarina, Victoria.

There is no State in the Republic of Mexico which possesses a better system of railway communication than that of Guanajuato. Wide as it is, however, the thriving condition of the country and its astounding rate of progress have already rendered an augmentation necessary; and, probably, before the present year is completed a further improvement will have been effected by bringing the Central line of railway right into Guanajuato City itself. At present, the Central main line stops at Silao, about 11 miles from the outskirts of Guanajuato, and whence, on a branch line, both passengers and goods are conveyed to Marfil, where a mule tram line joins on and brings everybody and everything into the city. Naturally much delay is occasioned by so slow a process of locomotion, and the advent of the new railway communication, with a Central depot in the heart of the busy city itself, will mean an immense benefit for the commercial and mining community at large.

The Mexican Central Railway crosses the State of Guanajuato in three different directions (1) from East to Northwest, on the line from Mexico City to Ciudad Juarez, or Paséo del Norte (154 kilometers); (2) from the centre to the Southwest, on the branch line Irapuato to Guadalajara, (84 kilometers); (3) from the centre to the Northwest, on the branch line from Silao to Guanajuato (23 kilometers).

The Mexican National Lines run from Southeast to North on the line from Mexico City to Nuevo Laredo, a distance of 271 kilometers, while the Salamanca and Valle de Santiago R. R. has an extension of 18 to 20 kilometers in theMunicipality of Salamanca. There are also some 14 kilometers of street railway, while a number of moderately good wagon roads traverse the State in many directions. The telephone and telegraph systems are, all things considered, in good and efficient operation, while a particularly well-conducted postal service is in force.

With regard to the future production of gold in Mexico, and in which the mines of Guanajuato have so much concern, the following observations of Minister J. Y. Limantour, in his report on Mexico's financial position for the year 1904-5, are worthy of reproduction:—

"Considerable importance attaches to the increase in the gold production, which last year alone showed a gain of $3,000,000 gold, equivalent in our currency to $6,000,000. The recent heavy investments of capital in gold mines augur a still more considerable development of this important source of wealth, and the substantial diminution of fiscal burdens will curtail the frauds that have been perpetrated on a large scale in the exportation of the yellow metal without payment of duties. For these reasons much is still to be expected from the gold production."

It should be added that on a subsequent page of the same Report the Minister estimates the probable production of gold in 1904-5, "in the old gold coins, of $14,429,223," and further remarks that, "calculating the value of the old gold peso at $2.05 of our present cur-

rency, which approximately was its average value during last fiscal year, the above sum represents in pesos of our present monetary system $29,579,908.07."

The second diagram which I give, and which is borrowed from the same source, as will be easily recognized, comprises seven main perpendicular divisions, each including four years total gold production, commencing with the period 1877-81 and ending with the period of four years 1902-5. At the margin on either side of the diagram a scale of million dollars is seen, rising from zero by equal divisions of five million dollars to a total of forty-five millions at the summit, the total output for each of four years having been computed from statistics. Vertical black columns, corresponding by their varying heights to the amount for each period, appear in each division, and in juxtaposition with the scale in the margin.

It will be seen from the total given of the production of gold during the four-year period 1877-81 on the chart, that, compared with that recorded for the last four years (1902-5), the production has increased by no less a sum than $42,383,203 (approximately, £8,476,640), or an increase of 118.3 per cent. in twenty-eight years. It should be added that in all cases on the chart where dollars have been converted into "£" sterling, the basis has been the standard gold peso, valued at about four shillings.

The "insets" on the diagram, dealing with the exportation as well as with the production of gold in Mexico for the last five years (1901-5), are not in need, apparently, of explanation.

Note.—The fiscal year ends on June 30 of each year.

GUANAJUATO: MARKET IN THE CITY.

A typical scene to be witnessed any day of the week.

Plate 7.] [See page 24.

Chapter III.

The "Patio" Process of Treating Ores.—Description of Methods.—Pan Amalgamation.—Comparisons.—The Growths of Mining Camps.—Great Revival in Guanajuato.—New Stamps Being Erected.—Companies and Mines Interested.—Blaisdell Process Introduced.—Humboldt and Guanajuato Mines.—A Curious Result of his Advocacy.—Silver as it is Found in Mexico and Europe.—A Native Author and Mexican Silver Ores.

IT is customary for those who think they know a great deal about mining, and with whom "a little knowledge is a dangerous thing," to condemn the "patio" process, which has been in vogue in Mexico for many hundreds of years, and is still to be found working upon many important and successful mines in this country. Here is one hacienda, "The Purisima," in Guanajuato working the "patio" to-day. Even the most sceptical and critical must admit that "defective" and "antiquated" as they consider this process of treatment to be, it has at least produced some wonderful results. It is of course attributable to the richness of the ores which have been treated, that they should have yielded such a bountiful return. Still, something has to be said for the much-despised "patio" treatment after all; and I thus deem it desirable to describe it in more or less detail before proceeding to consider the new and more complete system of treating the ores now being almost generally introduced.

We first hear of the "patio" process as far back as 1557. Who the pioneer was that introduced it, history fails to agree; nor, indeed, is the name much of an indication, since, if it meant anything at all, it signified

the place—viz: the "patio" or open courtyard of the Mexican hacienda—where the operations were carried on. Practically some of the methods in force 350 years ago remain unchanged to-day. As the poet Schiller tells us—"a deep meaning often lies in old customs"; and certainly there was meaning enough in the old methods of mining in Mexico.

The ore, when carried to the surface, was first broken by hand, generally at the mouth of the tunnel or shaft, both men, women and little children being employed for the purpose. In this condition the rock was conveyed to the hacienda, for, at that time, every mine was connected somehow, either by direct proprietorship or in partnership, with an hacienda, and there the ore was pulverized by means of Chilean mills, and "arrastres" run by mule-power. The ore was thus gradually, but somewhat tediously, crushed finer and finer, and even slimed. From the "arrastres" the stuff was carried to the "patio," and there, upon a wide stone-covered floor or pavement, it was massed in heaps, averaging from 20 to 400 tons. When a sufficiently large quantity had been accumulated, the whole mass of stuff was called a "torta." As is generally known, the ore, as it comes from the mine, contains a certain quantity of moisture, sometimes great and at others only slight; but it has to be partially eliminated before final treatment, and thus it becomes necessary to expose the "torta" to the air and heat of the sun for the purpose of being dried, but not too much. In this state the mass covers the pavement of the "patio" to a depth ranging from 12″ to 18″.

The operation next adopted is the adding of salt to

the ore in quantities which must be regulated by the character of the ore itself, and which only experience can successfully direct. Now are introduced the patient, plodding beasts, either horses or mules, which, yoked together, are driven around and around, and through and through the mass of slimy stuff. This goes on for hours at a time, the mixing becoming more and more complete. The stuff is then left for a period to settle, when sulphate of copper and iron are thrown in and thoroughly mixed with it, the amount again depending upon the nature of the ores being treated and regulated by the ripe experience of the operator. Quicksilver is also added in varying quantities, and a again a quotum of salt. The stirring process proceeds as before for a further number of hours, as a rule the intervals between the stirring being from twelve to twenty-four hours. The whole period needed for treating a "torta" is from 10 to 40 days. Many factors in determining the exact amount of time have to be considered,—such as the particular character of the ores, the season of the year and the amount of sunshine or rain. But when the time is considered sufficient for the process to have been completed, the pulp is washed away, the amalgam recovered and retorted and the bullion melted into bars or ingots.

This process, it must be remembered, was used almost entirely for silver recovery. Apparently, the old-time miners troubled themselves but little about the gold in their ores; but, to-day, it is the yellow metal which is proving the magnet of attraction to the fields of Mexico generally, and to those of Guanajuato in particular. I doubt very much whether the "patio" process ever could have proved a great success in treating gold-

bearing ores, even if it had been tried systematically, owing to the presence of sulphates. But for silver-bearing ores, as I have said, the process was found satisfactory, and is still so considered to-day. In those good old days, when time was not counted of any importance and an abundance of cheap labor was available, the process doubtless answered well enough. As much as $50,000.00 or $100,000.00 were locked-up in a mass of "torta" for any period ranging between two and two and one-half months at a time. But here, again, the old-time Mexican thought—"let the World slide, let the World go, a fig for care, and a fig for woe; if I can't pay, why I can owe, and death makes equal the high and low."

That is a kind of indifference which is dear to the Southern heart.

It is impossible to travel through the country around the Guanajuato District, or that of any other mining centre in Mexico, without having one's attention drawn to the number of haciendas, which at one time were no doubt busily engaged in conducting their "patio" process, but which to-day are in a state of ruin. Practically every hacienda had a "patio," where the owner treated either his own or his neighbor's ores, probably both. One can still see the cracked old pavements of the once thriving "patio" and the disused "arrastre" beds, many of which were run by water-power. As the mines change ownership, and the old order maketh way for the new, the "patio" process disappears.

Next to the "patio" process followed the stamp-mill and pan-amalgamation. Here, practically the same chemicals were employed, while artificial heat was also

introduced. The pan process has also now been condemned as "antiquated," and as a matter of fact it has never succeeded in maintaining the high percentage of saving that the "patio" process secured, the character of the ore and other conditions being equal. Half-a-dozen different mining men will supply half-a-dozen different explanations of this; but probably the real reason of the loss may be attributed to the presence of particles of iron in the pulp arising from the attrition of the stamps and pans. Some experts consider that the length of time to which the ore is exposed to the action of the mercury and the added advantage of the sun's regular heat, are among the reasons telling most in favor of the "patio" process. If the saving of the precious grains of gold and silver is not as large in the pan process, it is, on the other hand, far more expeditious, and that is a matter of considerable importance.

I believe that there was until quite recently a certain mill in the Tlalpujahua District which was working on the pan principle; I refer to the San Rafael. The Conception Mill was built there to treat the ores from the mine of that name. It had twenty stamps and a full equipment of pans, settlers and concentrators. Another mill of a similar kind was until a short time back to be found at the National Mine in the same district. In Guanajuato the Consolidated Company until lately ran a mill on the pan-amalgamation process, but this has now been changed to a cyanide plant concentrating above the tank. Other pan mills have also been converted, and the cyanide process of treatment substituted.

No one who has not personally witnessed the marvellous growth of mining-camps can form any accurate

idea of the rapidity with which these come into existence. Like Jonah's gourd, they "come up in a night," and also like that eccentric vegetable very often "disappear in a night," the exact period of their duration on earth depending upon the amount of precious metal found therein and the ability of the human delvers to get it out. This is the history of most new mining camps, and I have seen it repeated in the early days of Coolgardie and Hannan's Field in Western Australia, in Colorado, in New Zealand and in South Africa. But Guanajuato is *not* a new camp, having been founded as far back as 1554, and was famous as an ore-producer even in those days. Nevertheless Guanajuato is to-day showing some indications of that revival of interest in mining which characterized the early days of Western Australia and South Africa, to say nothing of the Klondike and West Africa, but without their feverishness, uncertainty and other discouraging features. The progress which has again set in in Guanajuato after a period of inactivity, or I might say intermission, extending back into the centuries, is as well-defined as it is well-founded. An evidence of this may be found in the increased number of stamps which have been erected, and those which are in course of erection. A dozen years back, perhaps, there were not more than fifty stamps working in this district. To-day there are several hundreds, and, by the time this humble work will find its way into the hands of my readers, I expect that some seven hundred stamps will be dropping day and night in this one district. I append a list of stamps which are actually in operation, together with those which, I have learned upon high authority, will be working within a few months' time:

GUANAJUATO: SPECIMEN OF CHURCH ARCHITECTURE IN THE MINING DISTRICTS OF GUANAJUATO.

Plate 8.]

[See page 23.

Name of Company	Stamps at Work.	Stamps in Course of Erection.
The Peregrina M. & M. Co.	20	100
The Cubo	20	—
The Nayal	10	10
The Central	5	20
Gto. Cons. M. & M. Co.	60	20
Gto. Redn. & Mines Co.	80	80
The San Prospero	—	40
Gto. Amalgamated Gold Mines	—	100
Noria Alta	—	20
Pinguico	—	40
Cedro	—	100
Refugio	—	50
San Cayetano	30	20

In giving the above figures, I wish it to be clearly understood that the stamps set forth in the second column are merely estimated, and are quite as likely to be added-to as deducted-from. Thus, while some of the mines may not proceed sufficiently far in their development to warrant the erection of so many stamps this year, others, such for instance as the group belonging to the Guanajuato Reduction & Mines Co. may exceed the number I have set down, for I am authoritatively informed that, if certain arrangements go through, the number of stamps erected by this company will be 1,000. In any case it is obvious that the number of new stamps in the Guanajuato District will soon be very considerable, while, as will be seen from the detailed descriptions of the various mines in this district, several costly installations such as that of the Blaisdell process and

the MacArthur-Forrest process of cyaniding, will have been introduced before the close of the present year, where they as yet have been absent.

It is a small wonder that mining prospectuses, emanating from Guanajuato, so assiduously quote the opinions of the late respected Professor Baron von Humboldt, since, owing to the enthusiastic manner in which he described this district, declaring it, at the close of the eighteenth century, to "have yielded one-fifth of the total amount of silver then current in the world," something like a boom in Mexican mining enterprises set in about 1825. We have no Professor von Humboldt today to sing the praises of Guanajuato, but we have something which is a great deal better—and that is a record of actual production and an ocular proof of the richness of the country which leaves nothing to the imagination and calls for no romantic description upon the part of gifted writers. Guanajuato can stand firmly upon its own bottom; and upon the future it can substantially lean without any fear of a fall.

The geological character of the country remains naturally exactly the same as when the invaluable von Humboldt described it in his studies of Mexican mineralogy. That authority declared "the common feldspar of the country belongs to the most ancient formations, which furnish twice as much silver as Saxony." We frequently discover only vitreous feldspar in the porphyries of Mexico. The veins of silver in the Real de Catorce, El Doctor, Xachiz, near Zimapan, traverse the Alpine limestone, and the rock reposes on a *pondin* with silicious cement, which may be considered as the most ancient of secondary formations.

The veins of Guanajuato contain common quartz, carbonate of lime, pearl spar, splintery hornstone, calcareous spar, a little sulphate of baryta and brown spar. The most abundant metals are prismatic black silver, red planet or vitreous silver, mixed with native silver and silber-schwartz. In the Catorce mines the gangue is decomposed, and is found to contain lime, spar, red ochre and muriated and native silver. One mine alone on the famous "Mother Vein" of Guanajuato, since the beginning of the 16th century, produced $300,000,000, and during ten years of its greatest activity about $60,000,000. The provincial treasurer's receipts from eleven of the principal mines during a period of eleven years, show a production of $80,000,000. All this white metal was shipped down to Vera Cruz, and the exports from that port annually equalled two-thirds of the silver extracted from all the mines of the world.

Although magnificent silver producers, it would be incorrect, as so many authors have done, to describe the Mexican silver mines "as the richest in the world." Rich they undoubtedly are and must continue to be for many years to come, but there are in Europe to-day some mines which are even richer. I refer to the Konsberg mine in Sweden and the Schneeberg mine in Saxony, where large masses of solid silver have been found from time to time, whereas the Mexican metal has been won from ores only and but seldom found in "chunks."

As a matter of fact the silver mines of Mexico are particularly valuable from the point of view of the almost unlimited amount of ore from which the metal is extracted, as well as the possibility of mining even very poor grade ores, and the cheapness of the native labor.

Records prove that rich pockets of silver have been encountered in Mexico, as in Peru and elsewhere, but, as I have said, it is the abundance of the low grade ore which really constitutes the richness of Mexican mines.

One Mexican author—Gorces—even went so far as to declare in his work "Nueva Tesrica del Beneficio de los Metales, Mexico," that "Mexican ores are for the most part so poor that the three million marca which the domain produces in good years are won from ten million quintals of ore." I may add that a marca of silver equalled 8 ounces, and a quintal (sometimes written "chuintal") was equal to 100 lbs., or 4 arrobas. In all probability Gorces drew his conclusions from one district only and, therefore, formed them falsely; certainly had he known Guanajuato as he should have, and as other authors then and since have known it, he would never have fallen into that gross error of describing Mexican ores generally as "poor." If these ores were "poor," I would like to know what he was pleased to consider "rich"?

Chapter IV.

The Mexican Labor Supply.—The Mexican and American Miner Compared.—Relative Merits and Demerits Considered.—The Peon and Public Holidays.—But 200 Working Days out of the Year.—Old Time Wages and Wage-Sheets.—High Cost of Mining.—The Meaning of a "Bonanza."—Hard Labor in the Mines.—The "Mozo"—How Peons are Usually Handled.—The Influence of the Parish Priest.—Brickmaking.—How the Peon Lives.—What he Eats and What he Wears.

NO one who has had anything to do with mining in any part of the world, who has ever read anything about the pursuit of mining or has ever held a single share in a mining concern, need be told that next to the possession of a mine at all comes the all important question of efficient and cheap labor. The Guanajuato mines are especially fortunate both in the quantity and the quality of their labour supply, and although the rate of payment is to-day more than double what it was say twenty or even ten years ago, it is still sufficiently modest to leave the employers perfectly easy in their minds as to its present and future condition.

People who study the pay-roll sheets of Mexican mines and compare the figures with those of, say, American miners, observing what is to them the extraordinary anomaly of a Mexican receiving but 75 cents as against an American's $3.50 gold a day, are apt to miss the very important point that while the former is "absurdly cheap" he is less than a quarter as good or as reliable. It is to be remembered that a Mexican laborer in the mines is only about one-half to two-thirds as efficient as an

American miner, while his number of "Saints Days" (over 140 in the year) render him less reliable as an instrument than his Protestant brother-workman. Apart from these facts, however, the Mexican miner is a good and fairly reliable worker, and in Guanajuato he is particularly plentiful. His rate of pay is 75c., Mexican Cy. (say one shilling and sixpence) a day, and in certain classes of work; such, for instance, as assorting, grading and masonry construction (which is paid at even lower rates), the Mexican is a distinct gain. Men receive an average payment of 75c. a day, women 50c. and boys 25c., all Mexican Cy.—surely a moderate enough rate when the fairly long hours of labor are considered!

Such things as strikes and "unions" are unusual, the Mexican being, as a rule, a perfectly tractable and fairly industrious worker, but requiring a careful overseer.

A mine manager of many years' experience in Mexico has placed on record his conviction that, in regard to labor efficiency, taken all round, and considering carefully all the *pros* and all the *cons* the Mexican miner is rather preferable to the American. Whereas the former is easily managed and does nearly all classes of work fairly well, especially excelling in working out and exhausting bodies of ore, the white worker demands much higher wages, quite disproportionate to the character and the amount of work that he does, and is additionally much more difficult to manage. While the Mexican can work underground well and easily and is an expert in stone and masonry work, the American is not skilled in underground stone work, although he is good at timbering, while the Mexican is not. On the other hand the Mexican, if he gets the chance, will become a thief

GUANAJUATO: THE PATIO PROCESS.

Plate 9.]

[See page 51.

and steal quantities of ore and tools from time to time, while he is prone to drunkenness and to occasional loafing. The American miner, while far from a saint so far as peculations are concerned, and loving as he does his glass of whiskey whenever he can get it, is on the whole more reliable, and having a due sense of honor, may be trusted with safety where a Mexican certainly could not.

One of the greatest objections to employing Mexican laborers is the enormous number of feast days which they persist in keeping, and which leaves them little more than 200 days out of the year for work. Both the farm laborers and most of the miners insist upon leaving their tasks on all Sundays and Mondays of the year; all feast-days of a national character; all feast days ordained by the Church; the day of the patron saint of the hacienda where they work; feast days of the patron saints of the nearby villages and churches; birthdays of the owners of the hacienda, and of the administrator; their own birthdays and those of the members of their families; days upon which the baptisms, weddings and funerals of the members of their families or of their friends take place; and on any other excuse, frivolous or serious, that may present itself. Things are somewhat improving, however, since several managers of mines and plantations now make it a rule to dismiss altogether any man who too frequently absents himself from his duties, a course of procedure which is having a markedly beneficial effect, especially since the Church itself is opposed to such absence except on its own solemn feast-days.

It is a source of wonderment to some how the former mine owners managed to make such colossal fortunes

from their properties, considering the heavy expenses to which they were put for labor, machinery, fuel etc., all combined, and which brought the total cost of their working up to something like $15 or $18 per metric ton, compared with but $5 to-day.

It cost them from $1.50 to $3 a ton to have the ore dumped on the "patio" and handsorted; all the ore from the stopes was carried painfully and slowly on men's backs to the shafts, dumped and rehandled there. The extremely hard physical exertion which this part of the proceedings entailed upon the luckless individuals carrying it out would horrify the "worthy souls" in England who lament the "slavery" of the Chinese employed on the Rand. Theirs is child's play compared to this arduous carrying of heavy sacks full of ore up an uneven, precipitous stair of stone steps, cut at uncertain distances, no more than 6 or 8 inches wide and as steep as 10 or 15 inches. Walking up or down such subterranean stairways as these, with no burden to carry, is trying enough; but to attempt it when heavily loaded, as I have described, is the most painful and exhausting labor imaginable. While the poor peons thus employed were miserably paid, the pay-rolls generally, owing to the number of men at work, were exceedingly heavy, amounting to from $4,000 to $5,000 weekly. Mr. Dwight Furness, one of the best-informed men in Guanajuato and the United States Consul there, has stated that even in the mines worked during the past ten years and under comparatively modern conditions, like the Esperanza and Cedro, the cost of mining averaged over $12 per ton of ore to the mills. In addition to this, the mills, being nearly all located on the banks of the Guanajuato River

on account of the water-supply as much as for security, heavy freight charges for transportation of the ores to the mills had to be encountered, being never less than $1.50 per ton and amounting to as much as $3.50 per ton. In those days it was the mills that made most of the money, Mr. Furness telling us that the mines were almost universally worked under the old "avio" or lease, all profits, except in times of bonanza being made in these mills, the mines in the course of time being looked upon merely as so many feeders to supply ore to the mills. The word "bonanza"—which is really a sea term—as applied here, I may point out, means a mine in such a state as to cover all the expenses of working it, and to leave a considerable annual profit to the proprietor. It implies no particular sum, for there may have been a "bonanza" of a million or a "bonanza" of only 20,000 dollars; but it always signifies among Mexican miners that things are proceeding satisfactorily—in short that they are "in the trade-winds," with studding sails set below and aloft and every prospect of a prosperous voyage.

Recalling the extremely arduous existences passed by the Mexicans employed in mining under their Spanish masters, and in the early days of their freedom from practical slavery, brings up the question as to what sort of labor the mines are enabled to depend upon to-day. This may be said to be abundant and on the whole cheap, or at least it appeared to be so until the several *pros* and *cons* in connection with native and white labor are carefully considered. Upon this phase of the question I have already commented (see page 62), thus affording opportunities for comparing the opinions

of various mine-managers who have had great experience with Mexican peon workers.

From what I have seen of the poen laborers at the mines and haciendas in Mexico, I should say they are a tractable and easily managed people, seldom rebelling against recognized authority, although upon occasions they have been known to indulge in rioting. A handful of local police will, however, speedily put an end to an outbreak, and a few cracked skulls the following day, combined with a broken-down door or so, are usually the sum total of damage sustained.

Especially useful and amiable is the body-*mozo,* of whom every mine possesses at least one, and as many as half-a-dozen. Upon long or short cross-country journeys on horse back the *mozo* is found simply invaluable and quite tireless. He thinks but little of himself, and never until every want and wish of his master have been met and gratified. Although to-day, when travelling in almost any part of Mexico, if I except the states of Sonora and Yucatan in some portions, is attended with no more danger than would be found to exist in Broadway or Piccadilly, the *mozo* is not required to defend his master from brigandish attacks, he would be perfectly ready to do so at a moment's notice, and to lay down his life for him if necessary. Although times have changed and are changing day by day, the *mozo* remains just the same faithful, trustworthy and careful servant, not over intelligent, maybe, or over cleanly in appearance, but as loyal and as dependable as one could meet anywhere in the wide world.

All the great estates or haciendas in Mexico have their *mozos* as well as their peon labour. Most of this is

hereditary, and almost as much of an inheritance as the estate or hacienda itself. The laborers here are *adscripti gleboe;* the owner of the hacienda is their feudal lord; they seek and obey no authority but his, and unless forcibly turned away they would seldom think of leaving him and his employment. So far, then, as the supply of such labor is concerned Mexico is peculiarly fortunate.

As an individual, the Mexican peon is not a loveable character—except for his fidelity. He is much like a child in many ways, and has to be frequently treated as one. He even fails to resent a chastisement from his employer, provided his conscience tells him that he has deserved it. I have seen a peon, knocked down by a heavy blow on the jaw from the fist of his enraged master, simply pick himself up more surprised than angry, and depart without the least evidence of any resentment. On the other hand a word of encouragement or a courteous "buenos dias" when met on the road, brings a smile of pleasure and gratification to his face, the genuineness of which is unmistakable.

The peon is slow by nature, very improvident, being practically born and invariably dying in debt, greatly addicted to drunkenness from indulging in too much of his beloved pulque, and spending his slender earnings upon cock-fighting and betting on lottery chances. He is seldom able to control himself under great provocation, and the use of the knife is painfully frequent even in the cities, being only rarely punished (as it certainly should be) by death.

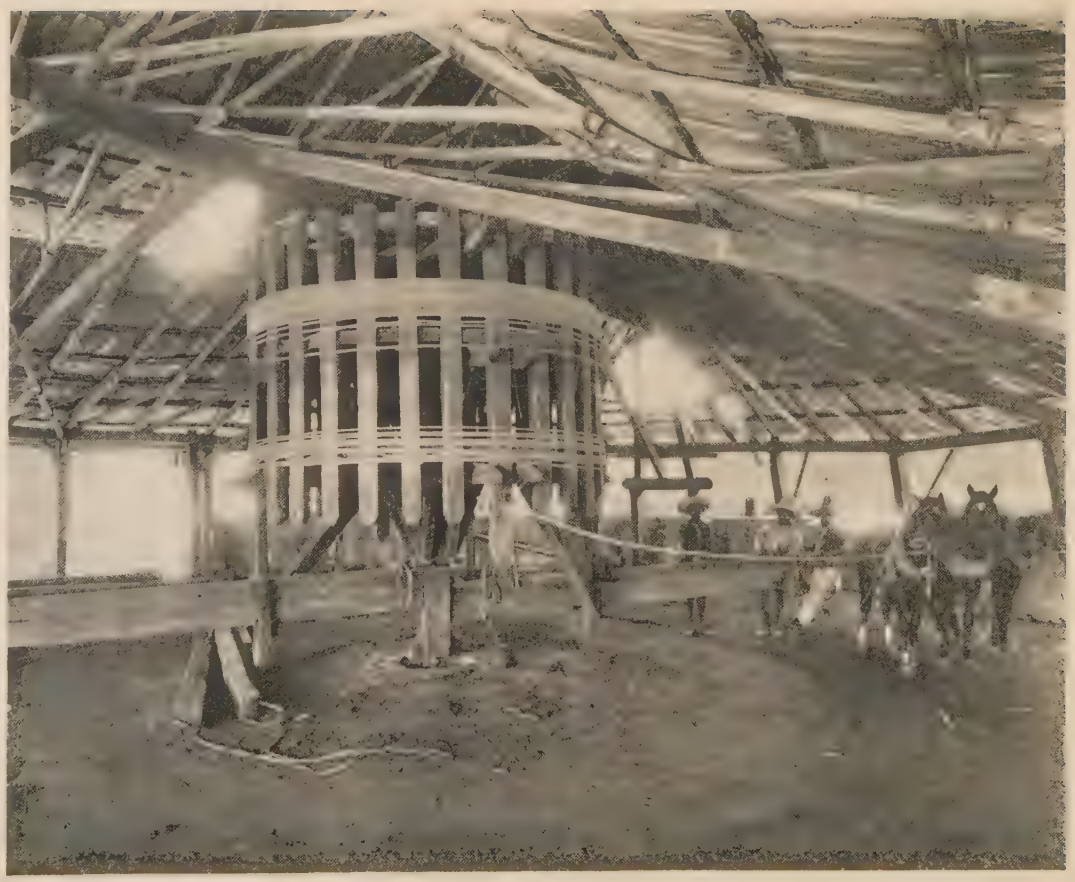
Perhaps one of the greatest faults possessed by the Mexican miner-peon is his thieving propensity. A very keen eye has to be continually kept upon him, otherwise

every tool in the mine would disappear in time, and great quantities of rich ore also. When the disappearance of the mining tools becomes unusually serious, the manager pays a visit to the parish priest, formulates a complaint, and then patiently awaits the favorable results which he knows will come.

The priest is generously treated by the mine owners and managers, for his personal influence is enormous and practically indispensable. He, on the other hand, could barely exist but for the "remembrances" of which he from time to time is the recipient at the hands of the mine-proprietors. So, on the Sunday following the theft of the tools, the priest preaches a solemn and soul-stirring sermon. With appropriate dramatic gesture he relates how "a certain dream" the previous night had attended him, "in which the faces and forms of certain among his flock came out clearly, faces and forms of those who had stolen wickedly the tools belonging to such and such a company, which paid them wages for their labor, but whom they shamefully robbed in return! How could he with all his prayers and penances hope to save from Hell's fires the souls of those who thus sinfully stole the company's tools?"

The next day those mining tools reappear as silently and mysteriously as they had disappeared, and let us hope many a repentant soul has thus been saved from perdition.

Long before the Spaniards came to Mexico the native races had travelled far upon the road to civilization; of this there is abundant evidence to-day. Their present backward condition may be attributed to the cruel persecutions, slavery and oppression which they had to un-



GUANAJUATO: THE HORSE-WHIM.

Specimens of this old hoisting machine may still be met with upon some of the Mexican mines.

[See page 51.

dergo at the hands of their Christian conquerors. For three hundred years they were kept in dense ignorance by the priests, their minds being alone filled with the most degrading superstitions. Is it, therefore, any wonder that the peon of to-day is but little better than his forefather intellectually, and can it be marvelled at that he is more successfully approached and controlled through fear and threats? The semi-torpid condition of the peon class is more the outcome of abuse and neglect than any natural defect of intelligence on their part. The next ten years, I should say, are destined to effect some change among the rising generation, but the evolution of the Mexican peon will be a slow and painful one from an educational and social point of view.

It is interesting to watch the peons at mines and on the haciendas making their adobe bricks, reminding one strongly of a scene out of the Bible, but not at all of the process described by Walt Whitman in his "Song of the Broad-axe,"—"The bricks one after another, each laid so workman-like in its place, and set with a knock of the trowel handle."

The peons use certain kinds of earth, tough and possessing special qualities known to themselves. They mix the earth with plenty of water until the mass resembles a thin kind of mortar. Cut straw is then added, and when this has been well mixed up in the mud, it is ready to be converted into bricks. The further process is simplicity itself. A frame, generally 24 x 18 inches, is used, which is divided by a cross-board into two even halves. This frame is placed flat upon the ground and the wet, earthy mixture is just shoveled into the two partitions, the top or overflow is scraped off, the frame work lifted

and the two bricks are left to dry in the sun. They are fully twice as large and about as thick as an English or an American-made brick, and of a dirty brown color. A skilful and industrious *adobero* (as the Mexican brick-maker is called) can easily make from 100 to 300 bricks a day. These are left for a couple of days to dry, being turned once or twice by hand. When sufficiently firm to stand upon their edges, they dry much faster.

Until some few years ago, practically all the mine buildings, as well as the houses in the interior towns of Mexico, were constructed of these adobe bricks, and some towns to-day still have some 90 per cent. of their buildings thus constructed.

It takes but little to sustain life in the Mexican peon, and it is astonishing to find these puny-looking, under-fed men carrying enormously heavy burdens, which no bulky English or American navvy would care to shoulder. The staple food of the peon is the *tortilla,* a flat, round cake, soft and doughy, made of coarsely-crushed maize. In the condition in which it is eaten by the Mexicans, roughly mixed and only slightly baked, and filled with a greasy mixture of hot chile and chopped-up onions, it is not particularly palatable to the average European or American. But these same *tortillas,* well mixed and properly baked, are agreeable enough, and when eaten with butter, having been previously toasted to a nice crispness, they are even delicious.

The peon rarely tastes meat; but when he does indulge in this luxury it is not the choicest portions of the animal that he can afford to buy. *Tortillas* for breakfast, dinner and supper, day in and day out all the year

around, form his main and in fact only refreshment, but apparently he thrives upon the treatment. Clothes cost him little or nothing, and house rent but a mere trifle. The male peon usually wears a loosely fitting suit of white cloth,—originally white, that is to say, and any old pair of sandals that he can pick up. His hat is a wonderful creation in size, being of the "Mother Goose" style known to us mainly through the pantomimes, and as dirty as the rest of his attire. His inevitable companion is his blanket, which he carries about with him all day and sleeps in at night. These blankets are usually of a cheap and but thinly-woven material, and can afford but little real warmth. The color varies, but for every blue, brown or other hue, one sees a hundred of bright red, that being the color mostly favored by the wearers. The women's costumes are of cheap and sober-colored prints—blue, brown and black; except upon holidays and feast days, when both women and girls adorn themselves in all the colors of the rainbow, adding much brightness and animation to the street scenes thereby. Some of the women and little children wear sandals, but many may be found barefooted. When not wearing the shawl-mantilla, women use the same steeple-crowned hats as the men and boys, these costing only a very few centavos a piece.

Chapter V.

The Guanajuato Consolidated Mining and Milling Company.—A Powerful Corporation with Numerous and Valuable Properties.—The Different Interests Controlled.—Plant, Machinery and Equipment.—The Sirena Group of Mines.—The Vein Area.—How the Vein is Worked.—The Cardonas Group.—A Valuable Mine in Prospect.—San Vicente and San Bartolo Groups.—The Barragana Group.—A Visit to the Mine.—The Milling Operations.—The Company's Financial Position.

THE Guanajuato Consolidated Mining and Milling Company was organized in the year 1898, to take over and work the Sirena mine, situated on the Veta Madre (or Mother Lode) of Guanajuato. Since its organization, the company has been gradually and persistently purchasing additional property until, at the present time, it owns at least six times the area of mining property that it possessed originally.

The following is a list of the properties which the Guanajuato Consolidated Mining and Milling Company owns outright or is interested in:

	Pertenencias.	Acres.	
Sirena Group.....	73.96	182.75	(Entire ownership)
Barragana, Constantina, etc.	67.50	166.78	(50 per cent.)
San Vicente, San Bartolo,	39.67	98.02	(63 per cent. and entire ownership respectively.)
Cardonas	12.00	29.65	(50 per cent.)
Total	193.13	477.20	
Carmen	48.63	120.10	(51 per cent.)
Grand total	241.76	597.30	

GUANAJUATO: QUICKSILVER ROOM OF AN OLD PATIO MILL.

[See pages 52–54.

Besides the above, the Consolidated Company owns 10 per cent. in the preferred and common stock of the Concordia and Rayas Company, one of the largest companies operating on the Veta Madre, north of the Sirena mine.

The milling plant and miscellaneous interests owned by this company can only be briefly described owing to their number, but, first, must be named the fine Hacienda de San Francisco de Pastita, adjoining the town of Guanajuato and covering a tract of land about 5 acres in extent, surrounded by a high wall, as is usual on all Mexican haciendas, old and new. In this area are situated the company's Stamp Mill, Cyanide Plant, Melting House, Assay Office, Power Plant, Electric Light Plant, Workshops, Storehouses, Local Water Works, Main Business Office, Residence, Stables, and Gardens.

The stamp mill is one of 80 stamps, recently finished, being equipped with the most improved modern appliances and machinery, which have completely replaced the old mill plant first built by the company. In addition to the 80 stamps, there are two Huntington mills and a complete concentrating plant of Wilfley tables, Johnsons and Frue vanners.

The cyanide plant is quite a modern one, consisting of 50 steel tanks and a series of masonry tanks, having an aggregate holding capacity of 2,300,000 gallons of pulp, and equipped with the pipe-lines, pumps, agitation machinery, zinc boxes for precipitation and filter presses, etc.

The power plant is both electric and steam, and consists of electric motors, having an aggregate capacity of 1,000 horse-power, with transmission lines for power

and light throughout the hacienda and to the mines. As an auxiliary to this plant, there is a modern steam-plant of Heine safety boilers, Corliss engines, etc.

A splendidly equipped mine tramway consists of a uniformly-graded track of 40lb. steel rails, laid to 26-inch gauge, extending from the stamp mill, in the hacienda, through a tunnel into the mine-workings, a total length of 8,780 feet, exclusive of side-tracks, which make an aggregate of more than 10,000 feet in length.

The water works consist of a Mata dam storage reservoir, in which are impounded the waters flowing in San Nicolas Creek, the most important branch of the Guanajuato River, together with intermediary dams, masonry aqueducts and pipe-lines extending between the dam and the company's hacienda, a distance of 11,437 feet, and thence distributed throughout the hacienda by branch pipe-lines.

The Sirena Group of mines, to which reference has been made, includes within its boundaries an area which covers 3,300 feet along the course or strike of the Veta Madre vein, by 2,000 feet from the hanging-wall of the outcrop of the vein horizontally over its dip, or downward continuation into the earth. The Veta Madre, having a dip angle of 45 degrees from the horizontal, the horizontal width of surface area of 2,000 feet, would include within its vertical boundaries a total distance or depth of 2,825 feet of the downward continuation of the vein. The total area, therefore, of the Mother Vein, within the Sirena group, is a rectangle, measuring 3,300 feet in length by 2,825 feet in breadth, which would contain 9,322,500 square feet.

This vein area is, however, further increased by that portion of the vein lying under the pertenencias covering the company's Purisima tunnel. This covers an area of 328 feet along the strike of the vein, by 984 feet over its dip. This latter dimension of the surface-area covers 1,392 feet of the vein on its dip; hence, 328 feet x 1,392 feet gives an additional vein area of 456,576 square feet, which, added to the 9,322,500 square feet already calculated, gives for the superficial area of the vein within the boundaries of this group, a total of 9,779,076 square feet. Reduced to larger measures to facilitate a more adequate conception, this area is equal to 225 acres.

To better understand the forgoing measurements, it should be borne in mind that the thickness, or width, of the Veta Madre ranges from 100 to 300 feet, and that under this group there lay 225 acres of this vein-matter, varying in width, within these thicknesses, and dipping into the earth at an angle of 45 degrees, and also that the greater portion of this area is, as yet, unexplored. This mass of vein-matter is believed to be ramified with masses and bodies of ore of as yet undetermined dimensions, while these bodies may continue in dimensions equal to those of the ore bodies now developed in the bottom workings of the mine, say, 100 feet or more in width, while it is possible that these ores may range from low-grade milling ores to high-grade shipping ores, so altogether a fairly accurate conception of the enormous extent of the Sirena mine and the clever engineering which is required for its systematic exploration, development and economic operation, may be formed.

The magnitude of this vein and the ore bodies which it contains is probably without parallel.

The Cardonas Group covers an area of 12 pertenencias of 29.65 acres, over the Veta Madre, and lies to the east of the Cedro. This group also practically adjoins the Carmen Group. There is considerable development work done on this property, and a large body of ore, having an average value of $12.50 per ton gold, has been developed. The prospect for a valuable mine in this group is exceptionally good; in fact it may be said that such is already assured.

The San Vicente and San Bartolo Groups lie in the Santa Rosa district. They contain within their boundaries two of the three veins that traverse the Santa Rosa district, and have made it famous as a mining centre. There is considerable systematic development of a substantial nature done on the veins in these groups, which has developed large payable bodies of milling ores.

The Barragana Group is located between the Peregrina mine, owned by the Peregrina Mining and Milling Company, which, as will be seen from the description of that company which follows, is erecting a 120-stamp mill for the treatment of its ores and the El Monte mine, owned by a Mexican company. The latter mine is accredited with a production of about $30,000.00 in the past. The work done on the Barragana Group shows it to hold out great promise of making as large and profitable a mining enterprise as its neighbor, the Peregrina mine.

The Sirena mine is the most prominent and the more extensively operated of all the company's mining properties. I was enabled to make a careful examination of

it, and the impressions received were highly and uniformly favorable.

Leaving the rock house of the stamp mill, at the hacienda, the journey to the mine is made in a flat car, "Pullman," over the well laid tram road, 3,500 feet, to the elaborately ornamental portal of the Purisima tunnel, the adit or main entrance to the mine; thence through this tunnel 2,500 feet to its intersection with the "Veta Madre," near the El Principe shaft, thence northerly through the vein, 1,300 feet, to the Soledad shaft, thence, continuing northward in the vein, a further distance of 1,476 feet to the end of the tunnel, and so on to the northerly boundary of the mine.

This tram road is tracked with 40 lb. steel rails, laid to 36-inch gauge, on a 1/10 of 1% grade, in favor of the loaded cars coming from mine to mill. This tunnel intersects the Veta Madre at a point 400 feet vertically below the surface. Below the tunnel level, the vein is developed through the two incline shafts named above, "the El Principe" and the "Soledad." These shafts are sunk on the vein below the tunnel level to vertical depths of 500 feet and 450 feet respectively, and, connecting these shafts with each other, tunnels are run in the vein an average vertical depth of about 100 feet apart. From these tunnels, at intervals, crosscuts are run at right angles towards the hanging and foot walls of the vein, and from these crosscuts raises are made through the ore bodies to the levels above. Thus the vein is penetrated with horizontal and vertical openings or workings, by means of which it may be examined and its physical conditions determined.

The tunnels in the vein are tracked with steel rails on which push-cars, having a capacity of three-quarter ton each, constitute the rolling stock. When the ore is broken in the vein, it slides by gravity down through chutes to the levels. These chutes are equipped with gates, at each level, which, when opened, allow the ore to pass through and fall into the push-cars. When these cars are full, the gates of the chutes are closed, the chutes acting in the meantime as storage bins. The loaded cars are pushed to the shaft by a peon carman, and the load of ore is dumped into the receiving bin, at the shaft station. At the point in the shaft where the level workings start through the vein, there is a large excavation called a "station." Under the floor of the shaft stations, large pockets are excavated in the hanging walls of the shaft, having a holding capacity of from two to three hundred tons. The bottoms of these pockets are provided with two gates, which, when open, discharge into the hoisting skips in the shaft. When the skips are full, a hoisting signal is given to the engineer at the top, and the skips are hoisted over steel tracks, and, on reaching the top, which is about 40 feet over the tunnel level, are dumped automatically over bar screens (called grizzlies).

When passing over these screens, the portion of the ore fine enough to pass through the openings in the screens falls through and is conducted to a separate compartment in the ore screen, called the "fines." The ore pieces which are too large to pass through the screen slide by gravity into a compartment adjoining that for the fines, and here the ore is known as the "coarse ore." These ore bins discharge their contents through chutes,

General View of the Guanajuato Consolidated Mining and Milling Co.'s Mill and Cyanide Plant.

Showing office buildings and manager's residence.

Plate 14.]

into steel cars, having a holding capacity of three tons each, which are hauled to the daylight by a 25 horse-power electric engine in trains consisting of ten cars each.

On reaching the surface, the cars containing the coarse rock are dumped into a storage bin, this having a capacity of 200 tons. At the bottom of this bin is set a Blake crusher which receives the coarse rock, as it is delivered by gravity from the storage bin, and crushes it to pieces, fine enough for the largest piece to pass through a $1\frac{1}{2}''$ ring. Thus crushed, the rock falls into the boot of an elevator, from which it is lifted 45 feet and delivered into a screen, and thence passes through the feed hopper, when it is delivered on to an endless picking-belt. This belt consists of steel slats 30 inches wide, and which overlap each other in an ingenious way, and is itself some 75 feet in length, between the carrying wheels at either end, and having a travel speed of 30 feet per minute.

The ore elevated from the crusher is fed regularly on to this belt, on which it forms a thin layer. On either side of the belt are stationed ore-sorters, who pick out the waste, or low-grade, ore as the belt carries its load past. About 20% of the weight of the coarse ore coming from the mine is picked out and goes to the waste, or low-grade dumps. By the time the belt has passed 12 ore sorters, 6 on either side, the ore which it carries is cleaned of all undesirable matter and the remainder is delivered into the clean ore bin at the delivery end of the belt. From this bin it is loaded into three-ton cars, and the coarse ore, with the fines screened in the mine, are run in trains of 10 to 12 cars and dumped into the storage bins at the Stamp Mill, which have a holding capacity of

1,000 tons. The ore thus delivered has an average value of $30.00 Mexican Currency (say £3) per ton.

And now begin the milling operations. From the mill storage bins, which are situated immediately behind the stamp batteries, the ore, already crushed as described, is fed automatically into the battery mortars, of which there are 16. In each of these mortars there are 5 stamps.

The crushing, or pulping, operation is carried on by means of these 5 stamps. Each of these stamps weighs 1,250 lbs., and is lifted by a cam and dropped 7 inches 100 times a minute on the ore which is fed into the mortar. The pulping of the ore is effected wet, 7 to 8 tons of water being fed into the mortar for each ton of ore. The front of the mortar is fitted with diagonal slot screens, equivalent to 35 mesh per linear inch. In the pumping operation the splash of the falling stamps, keeps the pulp in continuous agitation against the slotted screen, and, when the pulp grains are fine enough, the water carries them out through these screens. On issuing from the mortar, the pulp is sized, the slime going to the Frue vanners and the sand to the Wilfley tables. The concentration effected on these show a recovery of about 50% of the values in the crude ore extracted, in a concentrate weighing about 2.5% of the total weight of the pulp. The concentrates recovered by the Wilfley tables are sold to smelters and yield about 88% of their gross value in the form of bankable funds, net, to the company.

The pulp flowing from the Wilfley tables, and containing 50% of the gross value in the crude ore, is now subjected to a process of preparation for cyanide treat-

A Rich Portion of the Vein on the Fifth Level, Sirena Mine (Guanajuato Consolidated Mining and Milling Co.).

The black streaks shown in the photograph are the rich sulphides in the vein. These sulphides, when separated from the other material, run from $500.00 to $3,000.00 and $4,000.00 to the ton. The light-colored material is impregnated with silver sulphides, and comprises the milling ore.

Plate 15.]

ment. By gravity settling and hydraulic classification, it is separated into sand and slime, these occurring in the ratio of 40% and 60% respectively. The sand is then conveyed to the sand-leaching tanks, of which there are 20, and receives a treatment in these, varying from 14 to 16 days, during which time a recovery of values amounting to from 90 to 94% is made. The separated slime is submitted to the ordinary slime treatment in 20 steel tanks, where a recovery of values equal to that made in the sand is effected.

It should be said that the cyanide solution, after extracting the values from the sand and slime, is directed to flow through boxes filled with zinc shavings, where a precipitation of all the values is effected, in the form of an impalpable gold and silver powder. This powder is collected and melted into bars and sold.

The company receives, from its various methods of treatment described, about 85% net of the original values, in the crude ore milled, in the form of bankable funds.

The company owning and operating all the valuable properties which I have mentioned in the earlier portion of this chapter is naturally a stong one, financially speaking. The high opinion which the investing public hold of the Consolidated Mining and Milling Company's stock is proved by the price at which the shares of $5.00 stand to-day, namely $7.00, or nearly 50% prem.; while I have no hesitation in saying that, from what I have seen of the mine of Sirena, and from what I know of the management (which I can only characterize as efficient in the highest degree), these shares are worth $10.00 a piece, and may shortly reach that figure.

The whole authorized capital of the company is $3,000,000, divided into 60,000 shares of $5.00 each. There are bonds of the value of $300,000, in the form of 20 year 7% sinking fund convertible gold debentures. It may also be observed that a sufficient amount of stock is set aside for the redemption of the bonds as they mature.

The Board of Directors is a small one, consisting of four members, namely, Mr. Frederick L. Corning, President; Mr. C. V. R. Cogswell, Secretary and Treasurer; Mr. Robert Mulford and Mr. M. E. MacDonald. The latter gentleman, to whom so much of the present success of the company's operations is due, is also manager, while his equally able brother, Mr. Bernard MacDonald, is the consulting engineer. Mr. John S. Butler is the chemist and metallurgist.

The company has already commenced to pay dividends, having declared a quarterly distribution at the rate of 6% per annum. Up till now, the company has wisely used all its resources for thorough development, and to place in a perfect condition of efficiency its valuable properties. Henceforth the Consolidated Mining and Milling Company may be regarded as a permanent occupant of the dividend-paying list among the Mexican Mining Companies.

THE VEIN SHOWN IN THIS PHOTOGRAPH IS ON THE FIFTH LEVEL OF THE SIRENA MINE (GUANAJUATO CONSOLIDATED MINING AND MILLING CO.), THE WIDTH HERE BEING 163 FEET.

This vein was found in the hanging-wall from the main mother-lode quartz-vein, and recent development work shows that it has been found to continue in the hanging-wall from the fifth to the second level, a distance of about 500 feet, and it is expected that it will continue to the surface.

Plate 16.]

Chapter VI.

The Guanajuato Reduction and Mines Company.—A Group of Historic Mines with Romantic Associations.—The Stories of the Rayas and Valenciana.—Progress of the Centuries.—Interruption from the Revolution.—British Possessions Pass Away.—Modern Methods and Management.—How the Company was Formed and Who Formed It.—Some Tests of the Results.—Big Profits in Sight.—Treating the Ores on the Dumps.—A Plucky and Successful Experiment.—The Bustos Pipe Line.—The Company's 80-Stamp Mill and Machinery.—Financial Position and Management.

THE associations connected with several of the properties owned by the Guanajuato Reduction and Mines Company render their position a peculiarly interesting one, apart from the fact that their holdings form one of the most important and powerful groups in the whole district. The history of some of these celebrated mines is practically the history of Guanajuato (and its mining industry) itself.

As is probably well understood, in view of various descriptions given, the Mother Lode mines, the great majority of which are held by the Reduction & Mines Co., are divided into four different groups, namely:

The Valenciana Group, comprising the Valenciana, the Esperanza and the Tepayac;

The Cata Group, comprising the Cata, the Secho, the Maravillas, the San Lorenzo and the Avispero;

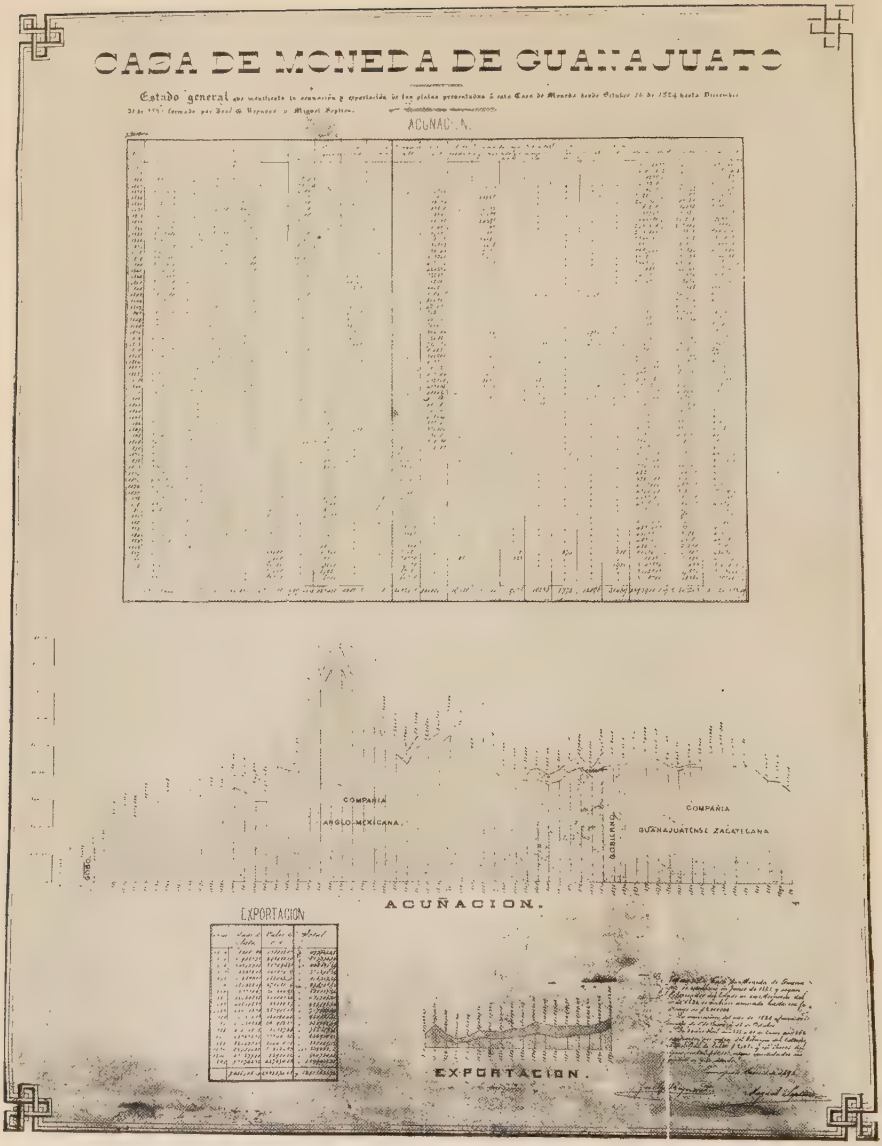
The Mellado Group, comprising Mellado and numerous annexes;

The Rayas, comprising the Rayas and its annex El Maguey.

These mines are the principal properties belonging to the Reduction and Mines Company, but in addition they possess La Union, Nuestra Senora de Guanajuato, El Obrero del Porvenir, and La Sorpresa. This last named mine was added to the company's holdings later on, and the sum of $100,000 gold (say £20,000) was paid for it.

In the La Luz district the company owns a large and extremely valuable group of properties, which are located on the La Luz, Rosario and other subsidiary veins, and comprise the Purisima with its annexes Santo Nino and La Palanca; Rosario; San Francisco de Pili; San Pedro Gilmonea; Emma; Loreto; Todos Santos; San Cayetano and Abundancia; as well as interests in Asuncion de la Navarra, Independencia and Plateros, and reversionary rights to the Mejiamora. A huge property adjoining the others and known as the Americana has also been purchased, and the entire property on the La Luz vein, purchased from the Rul Estate amounts to a length of 7,000 feet.

The first named four groups are all situated on the outcrop of the famous Mother Lode, and were purchased from the Rul Estate, which had previously purchased them from former owners or their representatives. It should be borne in mind that the Valenciana, the Mellado and the Tepayąc were originally the principal Guanajuato properties of the Anglo-Mexican Company, while the Rayas, the Secho, and Cata were among the holdings of the United Mexican Company. Nearly every one of these mines has a history of great productions, the Valenciana alone having a recorded output of something like $300,000,000 (say £60,000,-



GOLD OUTPUT FROM THE GUANAJUATO DISTRICT FROM 1824–1891.

[The above figures are very minute, but can be read by the aid of a powerful magnifying glass. AUTHOR.]

Plate 17.]

000) to its credit—an almost incredible amount for one mine to have yielded.

Some historians declare that the Guanajuato mines, taken as a whole, have produced ores to the value of $1,350,000,000 (say £270,000,000), of which no less than $1,000,000,000 (£200,000,000) came from the Mother Lode proper, and $350,000,000 (£70,000,000) from the mines on parallel vein systems, situated from 8 to 10 miles distant, of which the principal one is La Luz.

The early discoverers of these mines, before they passed into the hands of the two British Companies mentioned, gained fame and fortune from their possession. Thus, Señor Don Josê de Sardaneta, of Legaspi, owner of the Rayas mine, was created "Marquis de Rayas;" Señor Francisco Mathias de Bustos, owner of La Cata and Secho, became Viscount de Duarte; and Señor Antonio Obregon, of Alcocer, discoverer and owner of Valenciana, became Count de Valenciana. In this way was enterprise rewarded in the olden days; somewhat different from the present time, when successful mine owners—from South Africa—are denounced in the House of Commons as "thieves and slave owners" and the shareholders are termed "rascals," while the Government seeks every means to ruin them.

Romance clings with astonishing pertinacity to many of these Guanajuato mines to-day, and will never by the natives, at least, be allowed to die out. For instance, it is related of the Rayas mine that the owner, progenitor of the Marquis aforesaid, conceived the idea of carrying his levels forward to a point under the dip of the Santa Anita shoot, which was worked as an open cut. The old man dreamed of his great mine night after night, but

dying before he could accomplish his great object he enjoined his son and successor on his death bed to carry out his scheme, prophecying that he would succeed and "discover even greater riches and honors."

The prophecy was verified at first, for the Rayas mine became one of the most celebrated in the whole Guanajuato district; and put enormous wealth into the hands of the new owner of the property.

However, the prophecy was only fulfilled in part. The riches had come—and gone, but the honors still remained in the future. Convinced that his venerable father was inspired on his death bed and that he could not possibly be mistaken, the younger Legaspi persisted in carrying on the work of development to the southeast. He met with the ordinary experience of men who, since the time of Æsop, find many willing to advise one to "go on" and others who implore one to "stop." It was the case of the "old man and the ass" over again. Only Legaspi knew what he was doing, and he proceeded to do it. He persevered; and in due course of time his efforts were rewarded by the discovery of a second "bonanza," the riches coming from the shaft of San Miguel. Now, again, rose the fortunes of the Sardaneta y Legaspi family, and on this occasion the second part of the old man's prophecy came true, for the King of Spain made the Rayas owner "Marquis de Rayas"—for a small consideration—and an enduring monument to the great man exists to-day in the form of a magnificent building erected on the mine, with flying buttresses and a sculptured portal surmounted by a beautifully-carved statuette of the Archangel Michael ("prince of celestial Armies," as Milton called him) and tutelar Saint of this part of the mine.

The Valenciana, with such a magnificent record, naturally is not deficient in historical interest. In this case it deals with one Antonio Obregon, a Spaniard of great piety but with a keen appreciation of the good things of the world, and who, after vainly searching for some good pay ore, one day came across a poor and helpless individual, who, in return for certain kindnesses and benefactions, promised Obregon assistance in locating a rich strike. In due course his promise was redeemed, much to the surprise and let us hope the material appreciation, of the Spaniard, since he became thereby the richest man in the world at that time. His great piety found further expression in the construction of one of the most beautiful churches ever built by an individual. He began it in 1765 and completed it in 1785, the total cost being $1,000,000, or, say, £200,000. Nothing can exceed the costliness of the altars and their furnishings, and the Valenciana church, admirably preserved and most piously regarded by all Mexicans, remains the finest show place in Guanajuato—nay, in Mexico—to-day.

In the year 1700, more than 30 reduction works were in operation at Guanajuato, with a total capacity of 500 tons a day. Records exist which prove that progress in the 18th century was rapid, the mint, a pretty accurate index, showing that the yearly increase was considerable. During the first years of the new century the precious metals mined in Mexico amounted approximately to $10,000,000 a year. By the end of the century this had increased to an annual production of $23,000,000. This sum represented two-thirds of the world's production of silver during that period. From 1760 to 1810 Guana-

juato contributed 30% of the entire Mexican production and 20%—or one-fifth—of the entire world's output of silver.

The century was only 10 years old when revolution came stalking into Mexico, and from that time the mines —especially those of Guanajuato where the first echoes of revolt made themselves heard—commenced to suffer. As the great majority of the mine owners and operators were on the side of the Government—believing that in the end it must win and having naturally a keen eye for their own interests—the revolutionists had no mercy upon them and their properties, which were destroyed right and left, their workmen likewise being carried away as recruits, willing and otherwise. The out-put fell from $5,000,000 in 1810 to $1,000,000 in 1820. For fifteen years this condition of things prevailed, when an improvement commenced to manifest itself. It was at this time that the two British companies (the Anglo-Mexican and the United Mexican) already referred to came upon the scene and managed to buy up the half-ruined properties at a very low price, and being welcomed by the impoverished Government as the harbingers of fresh foreign capital—so sorely needed, since the country had but little of its own.

Among the very wealthiest of the Spanish residents in Mexico was the Rul family, which had for a hundred and fifty years been amassing property in the Guanajuato District, until they had collected properties covering more than 8,500 feet of the Mother Vein. Many, if not most, of these mines had been leased by the Rul family to British companies, and they, therefore, employed the funds paid to them for these by taking up

BOCA MINA, AT THE VALENCIANA MINE.

Property of the Guanajuato Reduction and Mines Company.

Plate 18.]

[See page 91.

other claims on the La Luz veins, which for 200 years had lain dormant in favour of the Mother Vein. The history and experiences of the La Luz district will be found more fully commented upon under Chapter XII, dealing with the Guanajuato Amalgamated Gold Mines Company.

At the time that matters were first brought to the attention of the Reduction and Mines Company, all of the properties of the Mother Vein, excepting the Cata, and all of the properties at La Luz, were filled with water and had been practically abandoned. The Cata had been unwatered to the 800 foot level, but was being worked in a hand-to-mouth fashion by a few "buscones" under most disadvantageous circumstances. The district, in general, was poverty-stricken to the last degree, as practically no mining work was going on and the mining population was, in a large degree, either at the point of starvation or was emigrating to other camps. The utmost discouragement prevailed throughout the district, but at this very moment a *deus ex machina* appeared in the form of Mr. Leonard E. Curtis. This gentleman, who was a lawyer, whose life work had been with the electric companies, came to Guanajuato in 1902 to investigate certain legal titles pertaining to mines controlled by Mr. George W. McElhiney, but, having a good deal of time on his hands, he and Mr. McElhiney made a thorough reconnaissance of the district. The enormous masses of wastes produced by ancient workings impressed him greatly, and he soon became convinced of Mr. McElhiney's views that the principal cause for the moribund condition of the district was the lack of available and cheap power. So convinced was he

of this, that upon his return to the United States he made a startling proposition to certain friends that they should expend something over a million dollars in bringing several thousand horse-power to a camp which, at the time, was using none and was, to all intents and purposes, completely dead.

His faith in the future, however, was contagious, and resulted ultimately in the establishment of the Guanajuato Power and Electric Company, whose first installed unit was capable of delivering 3,500 horse power into Guanajuato. This power-plant was opened in November, 1903, and is fully described under the head of Chapter XIV.

During this same time, two energetic young Americans, Mr. George W. McElhiney and Mr. George W. Bryant, had been extremely busy in getting together the large old mine holdings of the Mother Vein, and placing them in such legal form that a commercial consolidation could be effected. Having done this, the project was presented to Mr. George A. Beaton, of New York, who forthwith despatched to Guanajuato, to make preliminary examinations, Prof. R. T. Hill, one of the best-known geologists of the United States Geological Survey, with a corps of able assistants. Mr. Charles L. Kurtz, now the President of the Guanajuato Reduction and Mines Company, was also sent by Mr. Beaton to look over the general situation.

Mr. C. W. Van Law accompanied Mr. Kurtz in September of 1903 for a preliminary look-over the situation, coming again in November of the same year, when immediately upon his return to New York a large staff for sampling and surveying purposes was collected to-

gether, and from 100 to 200 men were told off to do the sampling work. The enormous quantity of the dumps resulting from past workings and their reputed workable grade at once formed the principal point of attack in the investigation, since, could these stores be treated at a profit, there would be provided a sufficient foundation for a large enterprise, leaving the mines themselves to follow as a secondary consideration.

As a consequence of the investigation, shafts were sunk through all the principal dumps to the original ground surface underneath, and hundreds of samples were taken, weighing from 500 to 2,000 pounds each, to determine the grade of the dumps. From the depths of the shafts and the contours of the ground surface underneath resulting, the quantities of the dumps could also be accurately estimated. At the same time, sampling investigation was pursued in the Cata mine and such portions as were available of the other mines, and it soon became evident that, leaving out of account any question of mine-ore from the vein proper, there was at least as much available material lying as "fillings" in the old stopes under ground as there was on the dumps.

All this, however, would have been useless without a metallurgical process which would economically and effectively extract the values from the ores. A five-stamp mill was leased in the outskirts of the town: the services of Mr. F. J. Hobson, who is one of the best-known silver-cyaniding chemists of the world, were secured to conduct the tests, and a large number of mill-runs were made on a practical scale from the dumps. The results were more than satisfactory. It was easily demonstrated that there was, as a minimum, $1.00 (U. S. Cy.)

a ton profit in some two million tons of dump ore already mined and on the surface, and not less than $1.50 per ton profit from the waste fillings under-ground, aggregating another million tons. There was the strongest reason to believe that the old mines, instead of being exhausted, might be counted upon to yield again a very large production of grade which would result in most handsome profits.

Under these conditions, options for the properties were quickly closed, and without waiting for the expiration of the time of the options' final payments, these were anticipated by about 18 months, and all of the properties taken over were paid for in cash. In order to assure the dip of the vein to much greater depths than they had before been worked, additional properties were also secured, both at La Luz and on the Mother Vein, which would allow of the working of the latter to about 5,000 feet, practically throughout the length of the holdings of this company.

In February of 1905, a thoroughly energetic and comprehensive construction program was commenced. A 150 horse-power compressor was installed upon the Cata mine with its complement of air drills, with which new levels were commenced below the old workings and driven as rapidly as possible, and with most gratifying results. A considerable flow of water having been encountered, large electric pumps were likewise installed in the Cata mine, and the unwatering from the Cata of the Tepayac mine was accomplished; the unwatering of the Rayas and Mellado mines in the same manner is now proceeding. Plans have been completed for a 1,000-ton mill to be located at Bustos Hacienda, right at the shaft

GUANAJUATO REDUCTION AND MINES COMPANY.

Interior view of precipitating plant, containing fifteen zinc boxes having six compartments, each 4×4×3 feet.

Plate 19.] [See page 99.

GUANAJUATO REDUCTION AND MINES COMPANY.

Sand leaching tanks, with slime tanks in background, showing sands under treatment.

Plate 20.] [See page 99.

of the Cata mine and at a point central to the entire system, where easy railroad transportation from all the properties can be secured.

In order to thoroughly demonstrate on a working scale the practicability of treating these ores, it was decided to install one-quarter of the ultimate unit immediately, deferring the completion of the full unit until this had been run for three or four months. During the construction of the mill, however, a five-stamp unit was kept running constantly, making cyaniding tests of the ores from the various mines of the company, with such results that the cyaniding question in all of its details was settled before the completion of the present unit, and active preparations are now under way to proceed with the increased capacity.

The position of the Bustos mill site, in a narrow valley with little flow of water to carry off the residues, made necessary a somewhat daring experiment, that of separating the crushing and concentrating portion of the plant by a distance of nearly a mile from the cyanide plant, which could be located on the main stream of the district where there is always sufficient water to carry away residue or tailings discharged. Against practically the unanimous opinion of all visiting engineers who were consulted, it was decided to carry the ores, after they had been crushed and concentrated, through a small cast-iron pipe, laid with uniform grade, from the Bustos mill to the cyanide plant situated in the heart of the city, utilizing simply the flow of the water in which the ore was crushed, due to the gravitation of the pipe. As the grade available was only 2¼% it was believed by almost every one that the sand could not be carried, and

that the pipe would inevitably be choked and stopped up. Certain experiments were made upon this matter which caused the company to proceed with their construction on the original lines indicated.

The plants were started March 1, 1906, and have been in constant operation, 24 hours a day, since that time. The pipe line, which was looked upon with so much fear by visitors, demonstrated at once that not only was there no danger of stoppage but that it would actually carry several times the volume of pulp treated with perfect ease, and with much less water than is normally used in the mere crushing and concentrating of ores. In fact, before the normal stamp-mill pulp, coming from the concentrators, is introduced into such pipe line, the company, by means of large settling cones, are removing something like 50% of the water and returning it immediately for mill use, the pulp flowing through a mile of 8-inch cast-iron pipe without experiencing the slightest difficulty, thus effecting the transportation of 250 tons of ore per day, for the distance of a mile through the heart of a crowded city, and this without a cent of expense. The pipe being, in general, buried throughout a considerable distance of its length, requires no expensive maintenance or inspection, and the right of way for such a line was, naturally, but a small fraction of what would have been necessary for any other means of transportation possible.

The ore is brought from the Cata mine in 4-ton gable-bottom cars to a large bin above the crushing plant, in which plant the ore is double-crushed to $\frac{3}{4}''$ cube by gyratory crushers, sorting likewise taking place on a sorting belt. The crushed ore is conveyed and elevated by

a travelling belt and distributed into the steel bin of the mill structure, which bin has a capacity of 2500 tons of crushed ore. The ore is then passed through "Challenge" feeders to the eighty (1050 lbs.) stamps, Allis-Chalmers pattern, making one hundred 7½" drops per minute. The mortar is of extra heavy "El Oro" type, weighing 9000 lbs., with extra broad base directly bolted to heavy concrete piers.

The 30-mesh pulp from the batteries goes to Wilfley tables, of which there are 24 in the mill, such tables having no elevators, the middlings, instead, being gathered at two common points in the mill, and elevated for regrinding in an Abbe tube-mill, this being re-handled over special Wilfleys before joining the tailings from the balance of the tables in a concrete launder running through the centre of the concentrator-room. This launder delivers into a tunnel which conveys the pulp to a cone-house where, in two steel cones, 20 feet in diameter, a portion of the water is removed and returned for re-use in the mill. From the cone-house, the pipe line above mentioned conducts the pulp to the cyanide plant, where a classification into sands and slimes is effected by a double cone system, the sands being received through Butters' distributors into either of two receiving tanks, and, after draining, discharged through 6-bottom discharge gates in each tank upon conveyor belts, which elevate and convey the sands over the top of a line of 40 ft. by 8 ft. leach tanks, into which the sand is showered by a special distributing tripper and handled by ordinary leaching process with 12-day leach time.

The overflows from all classifying cones pass over a trap to eliminate any sands which may have escaped, the slimes being conducted to 36′ x 12′ agitating-tanks, and treatment effected by agitation and decantation. The agitation is by means of mechanical arms supplemented by 6″ Meese & Godfried centrifugal pumps. After the final wash in the slimes tanks, the slimes are pumped into high settling-tanks, where a final settling and decantation takes place before discharge. All decanted solutions pass through sand filter tanks before entering the zinc room.

The zinc room contains 15 steel zinc boxes, of 6 compartments each, each compartment being 4′ x 4′ x 3′. At "clean-up," the precipitate is flushed through a hopper-bottom of each compartment into steel launders to a central sump, being thence pumped through a Johnson filter press, and, later, briquetted in combination with fluxes and melted directly into bars. No acid treatment is given, as nothing which will not pass a 60-mesh screen is sent into the filter press, all coarser than this being returned to the zinc boxes. The ores consist of clean, white quartz containing a small percentage of iron pyrite and silver in the form of argentite, without any other base in the ore.

Owing to the very large tonnage of material actually in sight, the system of construction followed has been rather unusual, the mill structures throughout being of steel, wood only being used for the floors and similar purposes. The masonry foundations over the entire plant are extremely massive, and the whole has been built with the idea of securing a minimum operating cost

GUANAJUATO REDUCTION AND MINES COMPANY.

Offices and cyanide plant at Flores Hacienda. Part of this building dates from the early years of the eighteenth century.

Plate 21.]

[See page 99.

and maintenance through a period of activity which will extend over a good many years.

The operation returns for the month of March, 1906, lately completed, evidence that the metallurgical extractions upon which the company's original plans were based will not only be reached but exceeded, and the operation costs, even at this early day, it can be said with certainty, will be less than the costs which have been figured on in all preliminary estimates. Whereas the original promotion of the company's enterprise was purely on the basis of low-grade dump handling, the mine developments have been such that the dump question is of less and less importance, and it becomes evident that, with a reasonable time for mine development, the mines will be perfectly able to carry the whole enterprise with a correspondingly much larger basis of profit.

The financial condition of the Guanajuato Reduction and Mines Company is an indisputably sound one, the affairs of the concern being in the hands of a Board of Directors many of whom are distinguished financiers and recognized commercial authorities. The following statement of resources and liabilities made up to the end of last year (1905) will show the precise position of this company:

RESOURCES.

Property Rights and Franchises.....	$8,747,442.34
Unsold Bonds in Treasury.....	569,472.45
Machinery, Tools and Equipment.....	15,266.34
Materials and Supplies.....	75,327.89
Furniture and Fixtures.....	6,956.62
Organization	53,237.39
Construction	304,863.51
Mine Development.....	80,636.88
Accounts receivable.....	166,953.76
Cash on hand.....	58,300.71
	$10,078,457.89

LIABILITIES.

Capital Stock.....	$7,500,000.00	
Bond Issue:		
Outstanding bonds.. $1,930,527.55		
Unsold bonds in hands of the American Industrial Development Company $569,472.45	2,500,000.00	
Accounts payable...	36,018.74	
Misc. Receipts.....	39,066.24	
Mexican currency adjustment — U. S. Currency equivalent @ 200.....	3,372.91	
		$10,078,457.89

The capital stock of the Guanajuato Reduction and Mines Co., as will be observed, is $7,500,000, to which must be added bonds of 20 years' life, and bearing interest at the rate of 6 per cent., bringing the total capitalization up to $10,500,000. The bond issue in circulation at present is $2,500,000, and the additional $500,000 of bonds will only be issued after the expiration of two years from the date of the mortgage, and then only for the purpose of providing funds for the purchase of additional property or to pay for increase or improvement of the company's plant. The Board of Directors is as follows: Charles L. Kurtz, Columbus, Ohio; John S. Bartlett, Boston, Mass.; Leonard E. Curtis, Colorado Springs, Colo.; Samuel M. Hamill, Schenectady, N. Y.; Henry Hine, Colorado Springs, Colo.; Leon O. Bailey, New York City; Clement A. Griscom, Jr., New York City; George B. Cox, Cincinnati, Ohio; Carlos W. Van Law, Guanajuato, Mexico.

The various high offices in the Company are filled by the following gentlemen: Charles L. Kurtz, President; Leonard E. Curtis, Vice-President; Henry Hine, Vice-President; Clement A. Griscom, Jr., Vice-President; Charles F. Dowd, Secretary and Treasurer; LeRoy Parker, Auditor; Frederick W. Stehr, Assistant Treasurer; Martin F. Turner, Assistant Secretary; Leon O. Bailey, Counsel; Carlos W. Van Law, General Manager; Pablo Martinez del Rio, Counsel at Mexico City; Carlos Robles, Counsel at Guanajuato and Pope Yeatman, Consulting Engineer.

Chapter VII.

The Story of the Guanajuato Development Co.—Methods of Financing and Assisting Promising Properties.—A Mutual System of Profit-Earning.—The Securities Corporation's Position.—The Guanajuato Representatives.—The Various Properties Described.—Their Early Development.—The Work Carried out and the Results Achieved.—The Pinguico.—Richest Ore in the District.—The Cedro Group.—Former Workers Neglected Great Opportunities.—Valuable Ores and their Treatment.

THE Guanajuato Development Company is an American Corporation, formed in the State of New Jersey for the purpose of acquiring properties in the Guanajuato Mining District, developing them sufficiently to prove their value, and, subsequently, offering them for purchase to other companies or organizing subsidiary companies upon them with sufficient capital to work them thoroughly. These properties are taken up on lease with an option to purchase the same outright, which affords an opportunity for the subsidiary company to prove the value of any property before actually taking it over.

The first operations of the Development Co. were to secure the right to purchase three mining properties and one ranch, all being situated in the district of Guanajuato. The capital of this company, which is $1,000,000 (U. S. Cy.) preferred and $3,000,000 common stock, is devoted practically entirely to making first payments upon such properties as it may take over, and to defray their initial development expenses, so that it may be re-

garded, in every sense of the word, as an "exploration" as well as a development company.

Being controlled, as it is, by men of great experience and with an intimate knowledge of the Guanajuato Camp, it is scarcely necessary to say that very few mistakes are made in the selection of properties. It is also worthy of note that, in disposing of its holdings, the parent Development Company asks for no cash profit, being willing to accept therefor a common-stock representation in addition to the amount of actual cash which it may have expended either for the acquisition of the properties or for their preliminary development. Thus the interests of the Guanajuato Development Co., and the newly launched enterprise, to which it disposes of its interests, are mutual. For its future profits, the Development Co. looks to its offspring, and is willing to share with them whatever success they may achieve, receiving in common with other shareholders the dividends which are paid on the ordinary stock of such subsidiary companies. No greater amount of confidence in the value of the properties of which it disposes could be demonstrated; in a word, the Development Company agrees to "sink" or "swim" with the purchasers of its holdings, whose well-being is its well-being likewise.

The Securities Corporation, Ltd., is a powerful American Co., and was responsible for the development and eventual flotation of the famous Peregrina Mine. It was also due to this Corporation that the Guanajuato Development Co. was brought into existence. The home of The Securities Corporation, Ltd., is in New York (40 Wall street), and it also has representatives located in most of the large cities of the United States. All of

the officers are men of considerable experience and undoubted standing in their respective communities, being in close touch with the investing public, and well able to form an accurate judgment as to the position and future possibilities of the different properties which they handle.

It is notable that these representatives receive no stated salaries, their remuneration taking the form of a commission resultant upon the sale of those securities which are taken up, and subsequently redisposed of, by The Securities Corporation, Ltd. This company, likewise, offers securities for sale, and adopts the very novel and sensible method of inviting its agents and representatives to personally visit the properties which it is proposed to sell to them. Prospective purchasers are in this way afforded every opportunity to examine such properties, and personally see for themselves everything which is claimed for them. All possible data and information are given, and nothing but the utmost frankness is practised, so that there can be nothing in future for the corporation to reproach itself with, should any unforeseen circumstances militate against the success of the undertaking. It is not in mortals to command success, as Addison tells us, but they can do more and deserve it; that is a dictum recognised and acted upon by all legitimate enterprises, among which The Securities Corporation, Ltd., may undoubtedly take rank.

In Guanajuato The Securities Corporation, Ltd., and the Guanajuato Development Co. are represented by Messrs. McElhiney and Bryant, both of whom for a decade past have made a close and careful study of Mexico, and especially of Guanajuato, as a field for in-

GUANAJUATO REDUCTION AND MINES COMPANY.

General view of the cyanide plant, showing leaching tanks with conveyor over and beneath them.

vestment. Although the word of these gentlemen would be accepted without demur, and their judgment respected by the majority of investors, The Securities Corporation, Ltd., has deemed it desirable to further strengthen its individual recommendations by employing other independent mining engineers upon all of the properties which Messrs. McElhiney and Bryant call to their attention. This was the method adopted in regard to the Peregrina Mine, referred to later on, and which is one of the properties which are to-day proving in every respect as valuable as the preliminary reports made upon them by independent experts, as well as by Messrs. McElhiney and Bryant, represented them to be. A similar method of procedure will be adopted in regard to all the properties which the corporation will offer for sale from time to time.

There are, at the present time, four properties in particular of which I would desire to speak, viz.: El Pinguico, El Cedro, La Central and the San Isidro Ranch, but before proceeding to describe these various holdings I would say that I have visited one and all personally and, therefore, do not write from mere hearsay or accept without further question the high opinions which have been passed upon them by others. Inasmuch as these properties are likely to be offered at no distant day in the form of investment, either in the United States or Great Britain—and most probably in both conjointly—I propose reviewing them in more or less detail.

Pinguico.—The word "pinguico" in Spanish means a certain class of shrub that grows prolifically in Mexico. The property so named comprises several mining claims, namely: El Pinguico, Ampliación del Pinguico and

San José, having a total superficial area of 121 acres. The claims were practically unknown at the time of their being acquired by Messrs. McElhiney and Bryant in 1900. They were taken over not on account of any particular mineral outcrop on their surface, but because, in an adjoining property, a very rich vein had been discovered, which, if continuous, would almost certainly lead directly into the claims of the Pinguico group. This step, therefore, showed great foresight and discernment upon the part of Messrs. McElhiney and Bryant, whose prevision has since been abundantly justified by subsequent events. At the time that the Pinguico properties were secured by the gentlemen referred to, and who eventually transferred them to the Development Co., the ore in the adjoining mine was nearly 2,000 feet away, but the vein in which this occurred was so strong and so apparently continuous that it was considered, by its then owners, to offer the attractions of a very safe mining speculation. In the six years which have transpired since then, work has been continued by means of tunnels and shafts for the purpose of reaching the orebody which was known to exist in the adjoining mine, and which proved to be continuous to the boundary-line of the Pinguico property.

It was only after four years' work (namely, in 1904) that these efforts were rewarded, and a year later (1905), the first profits commenced to accrue. During the period of exploration and development, a very considerable outlay had necessarily been incurred, — the ground proving particularly difficult to work, and the disappointments not a few. No expense, however, was spared in the provision of the necessary mining equip-

ment. The speculative value of this property having been proved by Messrs. McElhiney and Bryant, the Guanajuato Development Co. acquired all their interests therein, but at a very moderate price, the vendors accepting, as usual, their profit in the form of securities of said purchasing company.

The work which has been done upon the Pinguico property included the driving of several hundred feet through the ore which had previously been discovered by the original owners. The vein has been found to consistently grow wider and the ore as regularly to increase in value; the average value of this to-day is at the high rate of $50 U. S. Cy. (£10) per ton.

The ore contained in the vein of this mine is entirely different to any other which I have seen in the Guanajuato District and is, indeed, almost unique in character. It is of a clayey nature, which rapidly hardens upon being exposed to the air. I have every reason to believe the statement made to me "that the ore of the Pinguico mine is quite the richest that is found in the Guanajuato camp."

Work is proceeding actively at the mine in the 500 ft. level, and is advancing at the rate of 4 ft. per diem, through ore, which is, as I have stated, worth $50 U. S. Cy. (£10) per ton. The vein has a width of 20 ft. Workings both above and below this level assure 150 ft. above and 150 ft. below, so that every foot of advance which is made in this level practically guarantees 400 tons of this extremely rich ore. The ore-chute has been followed for over 200 ft.,—thus constituting the very richest chute which has been found of latter days in this district.

It is scarcely necessary to point out that the values which the Pinguico has been proved to contain came upon the original owners with something of a shock of surprise, and no doubt caused them to regret the precipitation with which they had tied up their property. What has been their individual loss, however, has proved to the advantage of the Guanajuato Development Co. as a whole, and of course a benefit to Messrs. McElhiney and Bryant, who receive their profit indirectly in shares of the company acquiring this valuable property.

My examination of the mine sufficiently proves that the present owners have allowed no question of initial expenses to interfere with its proper equipment and management. All the necessary offices and buildings are in excellent condition, including a blacksmith shop, storehouses, administration offices, dwelling houses, sorting-sheds, transformer house for the electrical current, etc., etc. The machinery, which consists of a 20 and a 50 horse-power electrical hoist, an electric blower, a 50 horse-power electric compressor and a 20 horse-power electric pump, are all in first-class order.

The workings consist of a 500 ft. cross-cut tunnel, which cuts the vein at a depth of 200 ft. below the surface. Upon this vein one 500 ft. shaft has been sunk from the cross-cut tunnel, and another 800 ft. shaft is at the present time being sunk from the surface, at a position selected at about the middle of the claim. It would probably be no exaggeration to estimate the net profit already in sight at $2,000,000 (£400,000), while a conservative estimate of the future foretells, with almost absolute certainty, a further $4,000,000 (£800,000) as

GUANAJUATO: ENTRANCE TO THE PINGUICO TUNNEL, AND SORTING YARD.

Belonging to the Guanajuato Development Company.

[See page 108

representing the ore to be blocked-out before the end of the current year.

Probably, shortly after these lines appear in print, the Guanajuato Development Co. will form a subsidiary company for the purpose of operating upon a large and comprehensive scale the Pinguico mining property. In the meantime, however, the development work will continue to further prove the value of the property, which will be later on transferred.

It only remains to be said that the claims of the Pinguico group are held upon unquestionable titles from the Federal Government of Mexico. The exact dimensions of the area which it holds are 3,300 ft. along the vein, and with deep level rights also amply protected.

The high values which were previously referred to are found exclusively to the south end of the claims and occupy only 600 ft. from the south end toward the north end. As the development work progresses toward the north, both the width of the vein and the values which it contains steadily increase. If it should be proved that these values endure along the entire extension of the ground, the Pinguico mine would become a celebrity for its richness as was the Valenciana (also in the Guanajuato camp) in its most halcyon days, and when it produced no less a sum than $300,000,000 (£60,000,000). That which has been, may be again.

El Cedro.—These properties consist of a large number of mining claims covering a superficial area of 200 acres, and including the following claims:

El Cedro.

Fractions between El Cedro and Guadalupe de Providencia and San Caralampio.

Fractions between El Cedro and Purísima Concepción.

Purísima de la Concepción.

Fractions between Purísima de la Concepción and El Cedro.

Guadalupe de Providencia.

Fractions betwen Guadalupe de Providencia and El Cedro and Nuestra Señora del Patrocinio.

San Caralampio.

Fractions between San Caralampio and Nuestra Señora del Patrocinio.

The above named properties are located on the celebrated "Mother Vein" (Veta Madre) of Guanajuato, of which I have previously spoken, and having an extension along that vein of about 6,000 ft. with deep levels amply covered. The properties were originally split up among six different owners, each of whom operated his own portion of the property as a separate mine, and in each of which a good ore-chute was developed and a large production of ore obtained. Under one management, it is scarcely necessary to say that the operating expenses are considerably reduced. During the 150 years which these properties have been worked, as much as $50,000,000 gold (£10,000,000) has been taken out of them. Some few years ago, a Mexican corporation was organized, which succeeded in purchasing from the six different owners who held the properties the whole of their rights, and in this way the much-desired combination of the various properties was brought about and form to-day what is known as the "Cedro" group.

The early proprietors, although they succeeded in installing a certain amount of modern machinery, were not

able to successfully operate the properties, nor, indeed, did they possess the funds necessary to erect an up-to-date treatment plant, without which no mining proposition of this character can ever become a thoroughly profitable enterprise. Success was attained, however, by efforts more or less spasmodic, as was proved by the values which the owners extracted from their properties, Sometimes they found very high-grade ores which produced enormous profits; but without a systematic operation, necessitating a large amount of working capital which they did not possess, nothing like permanent or regular success could be expected. It was not, therefore, difficult to induce the owners to sell out to the Guanajuato Development Company, under the usual provision of bond and lease, providing for obligatory development being done.

Messrs. McElhiney and Bryant were again the medium for the acquisition of this property for the Development Co., previously making an examination to assure themselves of the desirability of acquiring the mines, with the result of finding more net profit in sight in the mine than the total purchase price represented. The bond and lease under which the property is held call for the payment of the purchase price at the end of two years from Jan. 1st, 1906, during which time active development work must be continued, and this is going on both rapidly and consistently at the present time.

The vein passing through the Cedro property has an average width of 40 ft., across which it is mineralized in many portions—frequently for its entirety. The grade of ore found was not profitable under the old methods of treatment; but to-day, by means of modern mining

and milling machinery and the invaluable cyanide process, the mine is proving to be an enormously profitable investment. The former owners opened up the mine by means of four vertical shafts and two incline shafts, to an average depth of 700 ft. But a small proportion of the ground which was thus opened-up had been touched, as it was considered of too low a grade to produce profits by the old methods. To-day, this same ore, which carries about $12.00 U. S. Cy. (£2.8.) per ton, is capable of producing from $6.00 to $7.00 U. S. Cy. profit (£1.4.0 to £1.8.0) on every ton of ore which is mined and milled.

There are some 200,000 tons of "dumps" on the property, or what were called "dumps" by the original owners, but these really may be regarded as reserve heaps of ore, inasmuch as their value is very nearly $6.00 per ton, and will return a $3.00 profit on each ton after milling. The former owners of the Cedro properties had rejected vast amounts of "fillings,"—that is to say, ore which they had not thought it worth while to extract for treatment, considering it of too low grade; but the present proprietors will be able to mill these rejections with considerable success, since accurate tests have proved them to be capable of yielding from $4 to $5 U. S. Cy. per ton profit, by proper milling methods.

The workings of the mine traverse long distances untouched by the former owners, for the reasons indicated above. These bodies contain several hundreds of thousands of tons of ore, ready for breaking and sending to the mill, there to be turned into gold and silver bars and handsomely recompense the owners for their outlay.

Under the management of the Guanajuato Development Co., the Cedro group is having its workings considerably deepened and fresh enormous bodies of ore blocked-out. By the end of the present year the Development Co. will be in a position to form a subsidiary company on a large scale to take over and work the Cedro properties. It is contemplated to erect a mill having a daily capacity of from 300 to 500 tons, which, when completed and in operation, will secure a profit of $5 U. S. Cy. (£1) per ton on every ton of ore treated. The property, once in the hands of the operating company, will be equipped with all the necessary and most modern machinery, destined to be operated in a very efficient and economical manner. The Cedro property may be considered among the most valuable in the Guanajuato District, and yielding an average all-round profit of $5 (£1), means, considering the vast amount of ore already in sight and that yet to be blocked-out, a handsome return to those investing their money in it.

Chapter VIII.

The Story of the Guanajuato Development Company (CONTINUED). —The Central Group of Mines.—The Company's Scope and Methods of Working.—The Aparecida Mine.—The Victoria Mine.—The San Prospero Mine and Mill.—A Great River Dredging Scheme.—San Isidro Ranch and Dam Undertaking.

CONTINUING the description of the properties of the Guanajuato Development Company, I may now proceed to consider that important group known as La Central, and which comprises the following claims:

Ampliación de San Vicente, Canales, Nuevas cuadras de Canales, San Vicente, Nuevas cuadras de San Vicente, 3a. Ampliación de San Vicente, Santa Isabel, La Escondida, Alfa, Beta, Gama, Delta, Jota. All of these have a superficial area of 172 acres.

The mines are situated in the immediate proximity of the Cedro properties, already described, but they possess their own veins entirely distinct from those of their neighbours'. Some thirty veins traverse the property outcropping on the surface, and showing values in gold and silver ranging from $10 to $20 U. S. Cy. (£2 to £4) per ton, leaving a very handsome margin of profit for the operating company.

When the Guanajuato Development Co. took over these properties, they had already been worked for a year previously through five tunnels and four incline shafts. These workings served to open up twelve veins at depths ranging from 200 to 500 ft., and the ore-

bodies thus exposed were of the very high-grade, above mentioned. It was necessary to outlay considerable sums of money to further open up and work these veins, and to provide the necessary mills in which to treat the ores mined. The original proprietors were unable to obtain the funds required for this purpose, and were, therefore, ready to dispose of their properties to the Development Co. under the usual bond and lease terms, at the same time selling the mill which they had already erected, and which is sufficiently large to afford an earning capacity of several thousands of dollars per month, all of which profit is being put back into the property by the Development Co.

It is estimated that it will take a further period of 18 months to put these mines into efficient shape to produce a regular output of 200 tons per day. In due course of time the Guanajuato Development Company will organize a subsidiary company for the purpose of taking over the Central group,—in the mean time supplying sufficient sums of money to erect and equip a mill and furnish the mines with thoroughly up-to-date machinery. The anticipated result will be an earning capacity of $1,000 U. S. Cy. (£200) per day.

Some extremely rich pockets of gold-ore have been found upon the Central property, while specimens of native gold are frequently met with. During the past working, some comparatively small pockets of gold have been found which have produced as much as $1,000,000 (£200,000) in a few months. Anticipating a continuance of these lucky finds, the former owners entirely neglected to work the low grade for more sure profit-earning ores. Under the new management, it may be

taken for granted that, while the Development Company will keep a keen look-out for and extend a ready welcome to any more of these rich pockets, the less valuable ores will be vigorously and consistently worked,—the scheme of operation embracing the blocking-out of a large tonnage of moderate-grade ore, of which it is absolutely certain the mine contains vast stores.

The San Isidro Ranch.—Besides the mines to which I have referred, the Guanajuato Development Company owns the San Isidro ranch, which is one of the oldest properties in the State of Guanajuato, its titles dating back more than 200 years. It is situated up in the mountains, east and northeast of the famous mining district, and is precious from more than one point of view. In addition to possessing a large area of thickly-wooded scrub oak, it is exceedingly valuable for charcoal and pasturage, and will accommodate 5,000 head of cattle.

This ranch, moreover, comprises a very large drainage basin which will render possible a storing of a vast accumulation of water, to be used hereafter in the mines, mills and factories in Guanajuato, and for irrigating a huge area of rich agricultural land on the plains. The ranch covers some 16,000 acres, of which two-thirds are tributary to a single drainage-basin. This latter can be economically dammed and thus formed into a reservoir sufficiently large to contain nearly 6,000,000 cubic meters (1,500,000,000 gallons), while the ground having a much greater altitude than any of the surrounding country, the water can be supplied by means of gravitation to any point which is necessary for the purposes of the mines, mills, factories or irrigation.

GUANAJUATO: CLAIMS BELONGING TO THE CENTRAL GROUP OF MINES, SEEN FROM THE VILLAGE OF CARDONES

For every ton of ore milled in the Guanajuato camp, it is necessary to provide about five tons of water for each ton of ore that is treated; and in view of this, combined with the fact that the mines, as a rule, have but comparatively small quantities of water in them, and that the flow of the streams near by is practically nil (except in the rainy season), the value of the San Isidro Ranch as a storage-dam will be recognized.

As a matter of fact the mines will have to depend entirely upon the San Isidro dam for their future water supply, while the various mills, factories and farms will be fortunate in being able to secure so regular a supply, and thus render themselves independent of any climatic assistance.

The dam will be able to supply from its accumulated storage enough water to run thousands of stamps in the Guanajuato District, as well as irrigate, for a distance of from 6 to 10 miles, the rich lands which spread out in the adjoining plain. It is not unreasonable to anticipate a most prosperous and remunerative farming and agricultural industry in the Guanajuato neighborhood, since the new dam will be in a position to supply all the water necessary. Upon the San Isidro Ranch itself no fewer than 5,000 head of cattle can be pastured, and inasmuch as these animals could be purchased as yearlings at ten dollars Mex. (£1) and sold as three-year-olds for thirty to forty dollars Mex. (£3 to £4), the handsome profits which this enterprise can secure for the industry alone will be obvious. Taking this in conjunction with the regular annual revenue from the mines for the supply of water and the sales of the scrub-oak, the proposition

should be an extremely tempting one from an investor's point of view.

Cattle-raising has always been a very important and remunerative industry in Mexico, and carried on as it will be at Guanajuato on the San Isidro Ranch, under experienced management, it should prove by no means an unimportant asset of the Guanajuato Development Company. The Spaniards, in whose possession this ranch remained for over two hundred years, were keen believers in cattle-breeding, and by means of special legislation they made it the favorite occupation of the inhabitants of the country. Before their time, however, cattle-breeding in Mexico formed a very inconsiderable part of the country's exports; later on this industry was turned to somewhat better advantage, the hides being manufactured into leather and the tallow being used for the making of soap. Towards the close of the seventeenth and the whole of the eighteenth century, sheep farming became an industry of great value, especially in the northern and central provinces.

Guanajuato is one of the principal agricultural and cattle-raising States in the Republic. It ranks third in the list of cattle-producers, Jalisco coming first, with a value of $13,333,922; Chihuahua second, with $9,215,-465, and Guanajuato third, with $8,840,537. With the naturally rich pasturage and the abundant water supply which the San Isidro Ranch will henceforth enjoy, there is no reason whatever why the State's cattle production should not be materially increased by this fine property, as soon as it gets into thorough working order.

THE MANAGEMENT OF A GREAT ENTERPRISE.

When the Guanajuato Development Company took over the whole of the active Guanajuato business of the Securities Corporation, Limited, and of the Messrs. McElhiney and Bryant, it was also obliged to take over the management of all the properties previously managed by those gentlemen, with the result that to-day it controls, through its offices, the business of the Peregrina Mining & Milling Company, the Nayal Milling Company, the Central Mining & Milling Company, the Cedro Mining & Milling Company, the Pinguico Mining & Milling Company, the San Isidro Ranch, The San Prospero Mines Company and the San Matias Mill of that company, the Aparecida Mines Company, the Victoria Mines Company, the Guanajuato River Gold Mining Company, the San Mateo Mines Company, the Guadalupe Mines Company, the Navidad Mines Company and the La Luz Mines Company, as well as the personal properties of Messrs. McElhiney and Bryant and Mr. Peck.

In order to handle all these properties and to look after the construction of their mills, the equipment of their mines and the handling of their concentrates and bullion, a very large organization naturally is necessary. Mr. Geo. W. Bryant is the active business head of the company in Guanajuato, and in his office is found a technical staff covering every branch of a business which includes the construction of the mills, the equipment of the mines and the complete operation of both. To carry this out properly and in a systematic and well-organized

manner—as assuredly is done—it has been necessary to gather together a highly efficient technical corps recruited from every part of the world. Upon the staff of this company are to be found men who have graduated from technical colleges in every part of the globe, and who bring to bear upon the conduct of the various mines and properties the combined experience and ability of the best brains of the world.

The laborers employed are entirely Mexican, and it therefore becomes necessary that the managing staff should be efficient both in speaking and writing the Spanish language and possess a thorough knowledge of the capacity and customs of these people. It is hardly as simple, as may be imagined, to obtain employees possessed of these qualifications as it is to obtain men in the United States where but one language is spoken, and where both labor and material are more easily procured. In spite of these draw-backs, however, it can be safely said that the construction of mills and the equipment of mines with their necessary complicated machinery can be done more cheaply in Mexico, and especially in Guanajuato, than in any part of the West. As an example of this there may be mentioned the construction of the new Peregrina mill, consisting of 100 stamps (a complete description of which will be found in Chapter X), for the sum of $200,000 U. S. Cy. (£40,000) and the building of the great Peregrina dam, with a capacity of storing 100,000,000 gallons of water, for less than $25,000 U. S. Cy. (£5,000).

GUANAJUATO: VIEW OF THE MILL AT LA CENTRAL MINE.

Belonging to the Guanajuato Development Co.

Plate 26.]

[See page 119.

SOME PROMINENT GUANAJUATO PROPERTIES.

THE APARECIDA MINES COMPANY.—This company owns the following mining claims: "El Fenix," "La Perulera," "La Independencia," and "La Ampliación de Independencia." They comprise a total superficial area of 116 acres, and are located on the celebrated Mother Vein between Rayas (belonging to the Guanajuato Reduction and Mines Company), on the N. W., with its recorded production of $300,000,000 (£60,000,000) and the Sirena (belonging to the Guanajuato Consolidated Mining & Milling Company) on the S. E., with a production of over $50,000,000 (£10,000,000). The Aparecida claims cover about 2,000 feet along the vein, with the deep levels protected to a depth of 2000 feet vertically. The outcrop of the Mother Vein is very strong throughout the properties, and, in the crosscuts of the mine, a width of about 200 feet is constantly shown.

The property was worked on the surface in the early days, and large amounts of ore were taken out at that time. Messrs. McElhiney and Bryant, of Guanajuato, obtained an option for the purchase of the property in the year 1903, and then formed the Aparecida Mines Company, a Colorado corporation with a capital of $1,000,000 (£200,000). Sufficient capital was subscribed to carry out a certain amount of development work, which has resulted in the opening up of some very large, and unquestionably rich, ore-bodies. The ore deposits of the Rayas and Sirena mines, situated on either side of Aparecida, have been found to be the richest at

a depth at least 1,000 feet below the present workings of the Aparecida; so that it is perfectly reasonable to assume that further enormous tonnages of good ore are to be won from so wide a vein beneath the present workings.

It is the intention of the company to erect a mill and to thoroughly open up the mine to a still greater depth. Mr. Frank G. Peck is President of the company, and its offices are in Colorado Springs. Messrs. G. W. McElhiney and Geo. W. Bryant hold a large amount of stock in the company, as well as many Eastern people.

The mine is equipped with electrical machinery, and as will be recognized from the description of its situation, it occupies a very strategic position. Mr. Geo. W. Bryant is manager for the company in Guanajuato.

The Victoria Mines Company.—Some six years ago a group of Colorado mining entrepreneurs became interested in a piece of virgin ground located on the great Mother Vein of Guanajuato, and adjoining the famous Valenciana mine. Due to the fact that the surface of the claim was not promising, it had been left untouched for close upon three centuries. This group of Colorado people purchased the property, and formed a corporation known as the "Victoria Mines Co." With a full knowledge of mining and the risks which are usually entailed therein, they erected machinery and sank a modern shaft to a depth of 1000 feet, cutting the vein at about 900 feet and going right through it. They found ores running from $6.00 to $9.00 U. S. Cy. (say from £1.4.0 to £1.6.0), which at that time were not "pay"; and this fact resulted in

stoppage of any further work on the property. To-day, however, with the introduction of cheap electric power and of the cyanide process for treating the ores, this grade of ore will leave a profit, when worked, and the mine will undoubtedly be re-opened very soon. The claims comprise the following: "La Victoria," "Ampliación de la Victoria" and "2a Ampliación de la Victoria," with a total superficial area of 135 acres. Mr. Frank G. Peck is President of the company, and its offices are in Colorado Springs, Colorado. Mr. Geo. W. Bryant is General Manager in Guanajuato.

This is one of the properties which, there can be but little doubt, will develop rapidly in the future, and will be a testimony to the splendid courage of the men who sank deep shafts into that apparently barren ground.

The San Prospero Mines Co.—This is a Colorado corporation, of which Mr. Frank G. Peck is also the President, and Mr. Geo. W. Bryant the General Manager at Guanajuato. The property comprises the claims of "San Prospero," "San Francisco" and "La Ampliación," with an area of 70 acres. These claims are located about half a mile from the celebrated Valenciana mine, and its principal vein is parallel to the Mother Vein of Guanajuato, dipping at about the same angle and in the same direction. As an old mine, it was worked by open cuts on surface, frequently to a width of 50 to 60 feet; but at no time was any serious effort made to sink shafts and carry on proper mining work until Mr. Peck purchased the property in the year 1900. He immediately equipped it with machinery, and began systematically developing the property. At present

there is ample ore blocked out, with a value of from $10.00 to $12.00 U. S. Cy. (£2.0.0 to £2.8.0) per ton, largely in gold. For the working of the property and the building of the mill there was formed the San Prospero Mines Company, and in December of last year was begun the construction of a 40-stamp mill for the treatment of the ores of the property. In order to secure ample water facilities, Mr. Peck purchased all of the surface-land in the immediate vicinity, and which comprises several small ranches, thus securing to himself the entire water rights for his mill.

The mill, which is now nearly completed, comprises the usual crushing machinery, silver-plated amalgam plates, Wilfley concentrating tables, hydraulic separators for separating the sands from the slimes, tube mills for regrinding the sands, sand-tanks equipped with the Blaisdell system for automatically charging and discharging the tanks and in which the sands will be treated by cyanide, slime tanks with the Hobson patent agitating machinery for agitating the slimes in the tanks, precipitation house equipped with the latest methods for precipitating cyanide solutions on zinc, filter presses, furnace for melting precipitates, and, in fact, everything needed for the most modern, complete combination cyanide mill. This mill will have a capacity of from 125 to 150 tons per day; the motive power throughout is electricity, and the water is supplied by a series of large dams in which all the water collected from a considerable area is stored. While not the largest in the camp, the "San Matias" mill is, in every sense, absolutely complete, and no care or expense has been spared either by its original designer, Mr. F. J. Hobson, or its owner,

GUANAJUATO: THE NAYAL CUSTOM MILL, ADJOINING THE CENTRAL MINES.

Belonging to Messrs. McElhiney and Bryant.

Plate 27.] [See pages 239–240.

Mr. Peck, to make it thoroughly perfect in every respect; and it is but fair to say that it will effect a saving of from 90 to 95 per cent., if not more, while the entire operation will be carried out as cheaply as good management and automatic machinery can render possible.

The San Prospero mines will be otherwise thoroughly equipped with electrical hoists, compressors and pumps, so that mining there will be made as cheap as it is possible to make it. At the bottom and both ends are found good ore, and it is safe to predict a long and a profitable life for this attractive property.

A GREAT SCHEME IN PREPARATION.

The Guanajuato River Gold Mining Company. —For more than three hundred years the tailings from the many patio mills of Guanajuato have been discharged into the Guanajuato River, with the result of filling up a depression to a depth of more than 30 feet with finely-crushed sands, which extend below the City of Guanajuato for a distance of some seven miles. In the early days of the sixteenth, seventeenth and eighteenth centuries, milling by the patio process did not save nearly as much of the precious metals as the improvements of later years made possible, with the result that much of these tailings carried away in the Guanajuato River still retain good values. It is estimated that over 100,000,000 tons of tailings have gone from these mills into the river, and scarcely any of these tailings could have contained less than 2½ oz. of silver; and since but very little of the gold was saved in the old style mills, these same tailings must carry a

very large proportion of the yellow metal. The tailings in great quantities have been washed down the river and taken too far away to be of any immediate service; but nearly 10,000,000 tons of these sands still remain, carrying an average value of $2.50 U. S. Cy. (say 10/s) per ton.

The company joined with Mr. Geo. W. McElhiney and his partner, Mr. Geo. W. Bryant, in securing from the State Government of Guanajuato a concession to excavate and treat these tailings. Their concession stipulated the expenditure of a large sum of money within a certain length of time. This money was duly expended, in a very careful and thorough investigation of the quantity and value of the tailings, for which purpose excavations were made along the entire seven miles of the river course and bed, and the material was thoroughly sampled and tested after each excavation. Some extremely remarkable and high-grade deposits were discovered, and these were especially realised when the bed-rock was reached, where frequently large deposits of quicksilver, lost from the amalgamation mills, as well as of silver amalgam, also lost by the same process, could be scraped off the bed rock, while every crevice of the rock held a small pool of quicksilver.

The results of this investigation pointed to concentration as the best method of treating the tailings, and a small plant was erected, using electricity for power, and equipped with various kinds of concentrating-tables for the test work. It was found that a concentrate could readily be made carrying from $50.00 to $100.00 U. S. Cy. (£10 to £20) per ton, and represent a saving of about half of the values contained. The cost of exca-

vating the material from the river, separating the coarse rock from the fine sands and passing the sands over concentrating tables, was 25c. (say 1/) per ton, so that a very good margin of profit remained. The success attained upon a small scale has emboldened the company to erect a plant on a larger scale, having a capacity of about 3,000 tons of material per day. Such a plant should have an earning capacity of $3,000.00 per day and can probably work eight months in the year. There is sufficient material to supply such a plant for about 10 years, and it is confidently believed that it will return its entire cost with its first year's profits.

A still larger deposit of these tailings is found further below the ground held by the concession of this company, which is the property of Mr. Frank G. Peck and Messrs. McElhiney and Bryant. While the grade of the lower deposit is not so good, yet the tonnage is very much greater, and it is readily handled by the same means as in the upper part of the river. It is quite probable that these two propositions may be eventually combined, in which case the plant would be increased in size, and a profitable life of at least 20 years given to it.

This is undoubtedly one of the best propositions in Guanajuato to-day. It is possible to sample the values and measure the tonnage with absolute accuracy, while many deposits of extremely high-grade values, and also much solid amalgam and quicksilver, have been found. No effort has been made to include them in the average value of the tailings, and it is the intention to treat the material exactly as is done with the gold placers of California, the only difference being that, instead of re-

covering free gold, as in the case of California, the values will be recovered in the form of sulphides or concentrates, which must either be melted on the ground, cyanided, or sold to the smelters. Another point of difference between this deposit and the placers of California consists in the fact that the average value of the 14 miles of river covered by these tailings deposits is about $4.00 per cubic yard, while the value of those of California is 15c. per cubic yard.

The material will be excavated by dredging machinery, as is done in California, and it will then pass to concentrating tables, where as much as possible of its contents will be saved. It is to be greatly regretted that the values are too low to permit of economical cyaniding, but it is possible that in later years even this may be attempted with success.

The haciendas situated on the banks of the Guanajuato River, where in former days the patio process of treating the mine ores was in constant operation, and from which the discharged tailings fell into the river, were as follows: Casas Blancas, San Juan, La Trinidad and San Francisco. The last of these haciendas to operate the old patio process may still be seen working, being the only one of its kind now left, perhaps. Parmeo, Barrera Grande, Barrea en Media, Dolores, San Antonio de Barrera, Noria Alta, Cipreses, Rocha, San Pedro, Pardo, San Francisco de Flores, Purisima de Flores, Graniditas, Salgado, Patrocinia, Carrica, Escalera, San Matias, San Gavier, La Luna, Duran, Lucito, Bustos, San Augustin, Puerta Grande, San Geromino, and San Francisco Patista, are the other haciendas, many of which are now in ruins and deserted.

GUANAJUATO: THE SITE OF THE NEW SAN MATIAS MILL OF THE SAN PROSPERO MINE.

Owned by Mr. Frank G. Peck.

[See page 122.

Chapter IX.

The Peregrina Mining and Milling Company.—A Substantially Financed Undertaking.—A Mine with an Interesting History.—The Early Indians and their Work.—Description of the Peregrina.—The Veins.—How They are Being Worked.—High-grade Ores.—An Intelligent System of Development.—The Motive Power Used.—The Machinery as It Was and as It Is.

THE initial mistake made by so many mining companies situated in different sections of the world of attempting to commence the development of new mines without sufficient capital of their own, or a substantial financial "backing," has been avoided by the majority of the Guanajuato companies at present working in this district. One of the most substantial and successful enterprises is The Peregrina Mining and Milling Company, of whose properties I propose to speak in detail, first, however, desiring to point out that the great amount of success which has attended this company has been mainly due to the fact, that, from the beginning of its career, it has enjoyed the invaluable assistance and abundant resources of The Securities Corporation, Limited, of New York.

This great company paid for the whole of the exhaustive examinations and voluminous reports made upon the property, which required no less than five months to complete, and cost something like $20,000, or say £4,000. Engaged upon the work were two of the most distinguished mining engineers and metallurgists to be found in Mexico, namely, Mr. A. B. Carpen-

ter and Mr. F. J. Hobson, both of Mexico City. Some nine other American engineers were also engaged in this work, and it is only fair to say that, so far as expert knowledge and ripe experience can make anything absolutely certain in this world, the Peregrina Mine has been thoroughly and unquestionably established as a valuable and workable proposition. Nothing was left to chance for want of consideration, every ton of ore in the mine itself and on the dumps being carefully measured, sampled and assayed, while thorough discussions and consultations were held as to the most advantageous methods to be adopted for the recovery of the ore-values both by milling and cyanide process, and determining what should be about the cost of the treatment and its attendant results.

Having thus provided the means and opportunity for the Peregrina to be known and to "know itself," The Securities Corporation, completely satisfied from the examinations that it was not wasting its substance, consented to finance the enterprise all through, and subsequently acquired the property by purchase. The prevailing conditions of the markets at this time favored the purchasers, and the mines were acquired at a very reasonable figure. It is certainly worthy of mention, and may be carefully noted by English and American promoters generally, that the purchase price of the Peregrina was net to the proprietors, not a single dollar being added in the way of commission, promoters' profits or other "watering" before it reached the hands of the shareholders. Of how many similar concerns can this reassuring statement be truthfully said?

Thus equipped from its inception, and handled by men of ripe experience, untiring energy and strict integrity, the Peregrina commenced operations, and conducted in the same manner and under the same spirit, has to-day advanced into the front rank of the soundest and most valuable mining property in Mexico.

Like that of many of the most celebrated mining properties in the Guanajuato Camp, the history of Peregrina goes back for many years, being celebrated for its enormously rich silver ores in the pre-Independence days. There are certain old inhabitants still existing who remember their fathers and grandfathers telling of the great wealth drawn from these mines; but, successful as these early workers undoubtedly were, there is no question that they knew little or nothing of the real value of the mines, nor did they even know how to make the most of what they found there. The Spaniards ignorantly threw aside as useless thousands of tons of ore on to the "dumps" (that is, heaps), and to-day these same dumps are reckoned among the most precious assets of The Peregrina Mining and Milling Company. There is reason to believe that Peregrina was being worked and big quantities of ore being taken out by the Indians before Cortez ever set foot in the country, and the hateful name of Spaniard had come as a curse to the peaceful "Chichimecas," inhabiting this portion of the country.

Tradition is rich in regard to Peregrina, and among other records it is found that huge outcrops of the famous Peregrina vein, measuring 50 feet wide and of immense value, were worked by the primitive fire and water method, *i. e.,* building a fire in a tunnel in the wall

and then throwing cold water on the heated surface, causing it to crack and fall to pieces. To-day, that 50-foot outcrop has given place to a vast fissure 1,500 feet long, 100 feet deep and 60 feet wide, extending from wall to wall, and proving conclusively that if the old fire and water process of mining was slow, as it undoubtedly must have been, at least it was sure—for the Indians certainly got out rich silver and gold from the rock and used it.

But whatever amount they took out was represented tenfold by what they ignorantly or carelessly left in. They only troubled themselves about the richest kind of ores, as they knew them, fortunately for the present owners leaving intact numerous bodies of ore which measured in length anywhere between 400 and 500 feet and having a depth of about 150 feet. No evidence exists that the early workers knew of these valuable deposits, or knowing of them, troubled themselves in the least to wrest the treasures which they contained from the encumbering rock. In silver, these deposits yield about $20.00 or $30.00 a ton, but in gold—of which the Indians seemed to take absolutely no heed—there is a return of nearly $10.00 (£2) per ton. The stores of these valuable ores are almost exhaustless, including what has been blocked-out in the mine and what exists on the dumps outside.

Whereas the early Indians and their successors always regarded the Peregrina mine as a silver-producer and very little else, the mine is actually a valuable gold, as well as a silver, property. The proportion of the yellow to the white metal amounts to no less than 68 per cent. to 32 per cent. It may be mentioned that one parallel vein

Guanajuato: The Bryant Dam at the Peregrina Mine, which is now Completed.

in the south end of the mine carries 70 per cent. of gold and 30 per cent. silver in value. Under these circumstances, the Peregrina may legitimately be described as a "Gold Mine," and a very valuable one, too. By the present methods of working the ores, which I shall describe in detail later on, nearly all the values are recovered, whereas formerly they were only very imperfectly secured by the patio process.

The mine contains a main vein embracing about 3,874 feet of length. This has been developed for about two-thirds, say 2,558 feet and to a vertical depth of nearly 900 feet. The main vein may be divided into two portions, the northwest and southeast. In the first mentioned part, the workings contain no portion of the main vein in the upper levels; and it is only encountered at a depth of 597 feet from the surface. In place of the main vein, however, there is a complete system of smaller veins, all having in their time yielded abundantly. Splendid ore is found as the main vein is encountered, the width being exceptionally great. In some parts the width is nearly 40 feet, of which at least 14 feet have a value of $10 (or £2) per ton, while at one point samples taken and treated resulted in a return of $43 (£8/12) per ton. In the southeastern portion of the main vein the estimated amount of ore is over 300,000 tons, of a value of $10 per ton. Careful measurements have been made here as elsewhere in the mine, although some difficulty in actually securing measurements was experienced owing to this part of the mine being choked up with "fillings," that is, large quantities of discarded ore. A considerable part of the vein here remains undeveloped, but that the ore body continues to exist without any change in char-

acter cannot be doubted. Where samples have been taken, the results have been exceedingly satisfactory.

There are several valuable parallel veins existing both at the southeast and northwest end. The most important, perhaps, are the first named. The workings here are developed through crosscuts from the Barreno shaft, and drifts on this vein show a width of ore measuring over six feet. The vein dips towards the main vein at an angle of 80 degrees, the best of its ore running in chutes, one of which has a length of 154 feet along the vein. The value of this ore is about $9.75 (say £1/19) per ton. A good deal of work must have been done here in the old days, but some 6,000 tons of ore remain between the two existing levels. Several other branch veins run here, some of which, however, are only of a low-grade ore.

The northwest end of the parallel veins shows an extensive amount of working. One vein is nearly vertical, with a width of from one to three feet. The ore is found in pockets or chimneys and lenses, and has been proved to be of a high grade. Some of the ore has been tested, and has yielded a return of $50 (or say £10) per ton, and this over a width of three feet. Other samples have returned as high as $40 (£8) and as low as $11 (£2/4) per ton, but this part of the mine has been but little developed of late years, and contains great possibilities.

It is quite exceptional to find such an amount of ore of so consistent a grade as that in the Peregrina, bearing in mind the length of the workings with both ends open. Another feature is the constant width of the main vein, and the indications which it presents of becoming even wider. At the bottom level the ore chutes are remarkably well-defined, although the northernmost end, as I

have said, is as yet only partially and imperfectly determined. I was particularly well impressed with the lack of necessity for the use of expensive and cumbersome timber in the shafts, the nature of the walls of the veins being such as to render this superfluous. Then, again, a very small quantity of water is encountered, reducing considerably the cost of pumping, always an expensive and troublesome part of mining. The three large shafts which I inspected are admirably constructed, and are situated very favorably both for ore extraction and ventilating the mine. The Guadalupe shaft retains its steam hoist as well as its new electric hoist and is in addition installing a pump, when it will be used as an auxiliary pumping shaft. These shafts have the following dimensions: Guadalupe 1,050 feet deep; San Francisco, 900 feet deep; Barreno, 420 feet deep. The total value of ore in the mine measured upon four sides may be conservatively put at $2,500,000 (U. S. Cy.) or, say, £500,000 net profit to the shareholders.

I have already mentioned the valuable character of the dumps, but perhaps a few further words of description of these desirable assets of the Peregrina mine may prove interesting, and at least merit some attention. Some of these huge mounds of ore which, during the many years that the mine has been working, have been brought to the surface and there "dumped" down, have distinctive names of their own. Thus there is the Guadalupe Dump, composed almost entirely of ore from the main vein, and the Barreno Dump having 65,000 tons of $10.00 ore. It is protected on all sides by well built stone walls, two pits being sunk on the top. Samples taken from these yielded $8.50 (say £1/14) per ton.

There are probably some 18,000 tons of ore on the Guadalupe Dump, and all of about the same value. The total value of the dumps on Peregrina is well over $1,000,000 (about £200,000). This large amount of value must be added to that of the ore in the mines itself, viz: $2,500,000 and the mine fillings, representing a further $170,000, making a grand total of $3,700,000 (or say £740,000) in net profits.

The Peregrina, like all the other properties belonging to the same group of proprietors, is situated close to the City of Guanajuato, being about 7 miles distant. The locality is scenically a charming one, the mine being contained in a series of romantic-looking hills, part of an apparently endless range stretching away almost as far as the eye can reach. An immense undulating plain lies beyond on the other side, which, when irrigated, as is proposed, with the waters which will be stored up by means of a huge dam, constructed at San Isidro, will become a veritable Eden of agricultural prosperity. A winding wagon road connects the mine with the city, and over this tons and tons of massive machinery and supplies may be seen day by day being transported by mules. This is likewise the main road leading to other mines in the neighborhood.

The altitude is about 8,200 feet, and the atmosphere is as invigorating and as delightful as champagne. Working in such a locality means more to those who are employed there than the average mind can realise, since one of the greatest drawbacks and dangers attendant upon mining, namely, having to exist in a trying and perhaps a malarial atmosphere, is entirely avoided. There are no pestilential troubles to health nor noxious insects to deal

THE BARRENO SHAFT OF THE PEREGRINA MINE.

Belonging to the Peregrina Mining and Milling Co., Guanajuato.

with, the attendant climatic and atmospheric conditions being as favorable as the most exacting could demand.

The Peregrina property in area consists of about 160 acres, all told. The actual mineral rights consist of 65 pertenencias, that being the local title of a mining claim. The mill-site consists of over 15 acres, and has just been considerably extended to accommodate one-hundred additional stamps. Water rights permit of the collection of water and use of the same over an area of some thirty thousand acres, an advantage which need not be enlarged upon. Of the dam already in existence and a new one projected, I give fuller details elsewhere.

In no other part of the world which I have visited have I encountered a more thoroughly intelligent and complete system of development than that in vogue at Peregrina. Even before the present owners took over the mine, an enormous amount of development had been gone through, the Mexican proprietors having spent much time and energy in searching for the silver, but, as already pointed out, leaving out of their calculations the magnificent gold-values, and overlooking some of the finest silver-bearing veins also. There is little which has been lost sight of by the present proprietors.

It has been estimated that the work already carried out in drifting and raising on the main vein apart from the shafts, amounts to miles of drivage, this having cost $250,000, or, say, £50,000. Almost the whole—certainly nine-tenths—of these miles of drifts and winzes is in good milling ore. The three shafts on the mine have been most advantageously located, and the ventilation of the workings is perfect in all respects. So much having already

been done, and all in a systematic manner, the present further development has been proceeded with under exceptionally favorable conditions.

The present depth of the bottom level will not have to be exceeded for a long time to come, there being abundant ore above it for many years. The management are now continuing the drifts to the northwest on the two bottom levels, and every fresh 50 meters driven here means another 10,000 tons of ore blocked-out between the levels, and as much again above as below.

The south, or Carmen, level, is also being continued, and is thus extending the large and well-defined ore chute, so that this, in view of the great width of the vein that is found, means an enormous quantity of new ore being developed at a very little expenditure. In the near future the "Barreno" shaft will be further sunk; and this will, as a matter of course, still further extend the amount of tonnage in the south end of the mine, as well as opening up the latter for economical extraction.

Owing to the scarcity of fuel in the district, which never at any time could have been great, but which has been growing less and less for many years past, the former workers must have found great difficulty and heavy expense in running what machinery they had. Today, a complete transformation has come over the mining industry at Guanajuato, for the necessary motive power is that of electricity. Both the mines and mills are admirably equipped with the latest forms of machinery of this character, the current being furnished by the Guanajuato Power and Electric Co. at a very reasonable price, considerably less, I may say, than many mines have to

pay out West, but which still leaves a handsome profit to the supplying company itself.

The motive power travels over 100 miles by cables from the State of Michoacán, and elsewhere will be found a description of the origin of the Guanajuato Power and Electric Co. and its methods of supplying the mines and the City of Guanajuato. For the two years that the company has been doing business the utmost satisfaction has been afforded to its customers. Guanajuato is, in my opinion, one of the best-lighted as it is certainly one of the most romantically located places in the Republic of Mexico. The town, or rather City of Guanajuato, possesses nearly 80,000 inhabitants, this number being considerably added to day by day as the attractions of the mining district become better appreciated.

One of the most valuable improvements introduced by the new management at the Peregrina, when the mine was taken over from its former owners, has been the construction of the Bryant dam, which has a holding capacity of 93,000,000 gallons and a working capacity of 186,000,000 gallons. The height of this structure is 24 meters, and it has a length of 100 meters; the total cost of building having been $25,000, or, say £5,000.

The crushing plant and machinery which existed in Peregrina before The Securities Corporation, Ltd., became the owners, included the Kinkaid mills, having a capacity of 40 tons daily, but they have been superseded by a 20-stamp mill.

The present plant also comprises the new and very complete 20-stamp mill, amalgamating plates and Wilfley concentrators, treating over 70 tons a day of the

highest grade ores. The construction of another large mill, having 100 stamps, is also proceeding, the foundations being now complete, and by the time these lines appear in print in all probability the hum and thud of the full 120 stamps on the Peregrina mine will be heard day and night, having a combined capacity of no less than 320 tons of ore daily. The average value of the stuff passed through may be taken at $10.00 (£2) per ton, yielding a profit, after all expenses, losses and taxes have been deducted, of $1,700.00 (£340) per day, which, working only 340 days out of the year, is equal to $500,000.00 (£100,000) a year.

Besides the crushing machinery in use in the two mills, there are working a 150 horse-power steam hoist, situated at the Guadalupe shaft, and a 30 horse-power steam hoist on the San Francisco shaft. Both of these hoists are what is known as of the double-drum type, and are being used for the extraction of water as well as of ore. An additional hoist of 55 horse-power operated by electricity, has been erected at the Barreno shaft and a 150 horse-power electric hoist is being installed at the San Francisco shaft. A 70 horse-power compressor, electrically driven, works the air-drills of the mine, and a 50 horse-power electric pump will take out the small amount of water made.

Although upon the Guanajuato mines a general type of crushing machinery is in use, some of the managers adopt one system of treating sand and slime and some another. There is as much difference of opinion prevalent among mine managers as to which is the best treatment of ores, as there is among other experts in relation to other industrial enterprises. Again, each particular

mine has a particular kind of ore, and naturally what is found to be most advantageous and economical for the one need not necessarily be equally beneficial for the others.

On the Peregrina mine an important installation will be made this year, namely, the Blaisdell process of handling the sands.

Chapter X.

The Peregrina's Equipment.—The Mill.—How the Ores are Treated from the Time They are Brought to the Surface Until the Production of Gold Bars.—The Crushing Machinery.—The Stamps, Dies and Shoes.—The Wilfley Concentrating Tables.—The "Sponge."—Concentrates.—The Blaisdell Process Described.—The Economy Effected in Labor.—The Peregrina's Remarkable Extractions.

THE Peregrina stamp mill, consisting altogether of the 120 head of stamps, is connected with the mine by two tram lines. The ore is brought over this line in steel cars with a capacity of 1½ tons each, and out of them the stuff is dumped into bins having a holding capacity of 200 tons. From the bins the ore is fed automatically through two Gates ore crushers, wherein it is broken up to a size that would pass through a ring having a diameter of 1½". From here the stuff is conveyed to the ore-bins, having a holding capacity of 1,000 tons, behind the stamps, by means of a belt-conveyer, and discharged by a tripping device which is under perfect control, making it possible to fill the bin to its fullest holding capacity. Passing from the bin, the ore is fed to the heavy stamps by automatic appliances into the mortars, in which the stamps drop. The weight of these heavy stamps is 1,050 lbs. each, while the mortars themselves have an individual weight of 9,000 lbs. The massive mortars are set upon concrete blocks, securely held down by heavy iron bolts which pass down through the battery block, having stirrup-shaped loops in which are fixed pieces of 60 lb. steel rails.

The battery block is 180 feet long, 6 feet wide at the bottom, 4 feet wide at the top and 6 feet high, accommodating the full 100 stamps. These are divided up into groups or batteries of 5 stamps to each mortar. The stamps have a drop of from 6 to 8 inches, with about 90 drops to the minute.

Simultaneously with the automatic feeding of the ore to the mortars, water is introduced, so that while the stamps are being lifted by means of the revolving cams, fixed upon the cam-shaft and dropped at regular intervals, the ore is being crushed and wetted at the same time. The "shoes" fixed on steel stems meet the dies as they drop, and thus crush the ore which is continually falling from the bin between them. Both shoes and dies are composed of the hardest kind of steel so as to successfully withstand the hard work which they have to perform. The action of the dropping stamps sets up automatically a splashing and washing motion of the mixed ore and water, so that so soon as the ore has been crushed to the proper size, it is washed out through the front of the battery where it is met by a frame carrying screens. The screens used in various mills differ somewhat as to their coarseness or fineness, but those at the Peregrina mill have a mesh of 30 sqs. to 1 inch, that is to say, 30 small openings to the linear inch.

The crushed material has by this time assumed the character and is known by the name of "pulp," being quite liquid in consistency. The pulp now passes over amalgamating plates of copper which have been previously silver-plated and charged with quicksilver. As the pulp passes down and over the surface of these amalgamating plates, the particles of gold, coming into contact

with the quicksilver, are held fast, the rest of the liquid flowing away, but leaving about 40 per cent. of the precious metal behind on the plates. These latter are scraped, and the gold is thus secured.

The next stage of the milling process is the treatment of the liquid, still containing, it will be remembered, 60 per cent. of the gold and silver particles. The pulp flowing through the screens is thrown on one side of the copper plates, which have a width of 40″ and a narrow strip of wood affixed as a dividing line in the centre, extending the entire length of the plates, namely, 8 feet. While the pulp is flowing along on one side of the plates, the mill-men (having first washed the plates) add more quicksilver, the object being to soften the coating of gold which has formed into a hard surface as other particles have been washed over it and have adhered. When the desired degree of softness has been attained, the whole of the deposit is removed by means of a rubber squeezer being pushed up and along the surface of the copper plates. By this action all the soft amalgam, or deposit, is removed easily from the one side, after which the flow of pulp is transferred to the other side and the same course of procedure is followed. When the plates have been thus completely cleaned and all the soft amalgam removed from the plates of one battery, the process is continued to all the other batteries. The whole amount of soft gold deposit collected is now placed in a chamois leather, and subjected to a process of squeezing. The greater part of the quicksilver runs through and is preserved for future use, while all the gold particles, as well as the other foreign matter, are retained, forming a ball which is technically termed "hard amalgam." This mass

contains about 20 per cent. of gold and 80 per cent. of silver, quicksilver and other matter.

The next step in the treatment is to separate the gold from the silver, quicksilver and other matter with which it is still mixed. The whole of the rough amalgam is put into a retort and placed in an iron pot, with a tightly fitting lid. Inserted in this lid is a pipe, which, while the pot (with its retort) is being subjected to a red-hot heat in the furnace, connects with a tank of water. The intense heat of the furnace causes the quicksilver to become volatile and pass off in the form of vapour through the pipe, but upon again coming into contact with the water the quicksilver condenses, and, falling to the bottom of the tank, is eventually recovered and used over again. The quicksilver having now been entirely got rid of from the amalgam, the retort, having previously been allowed to cool, is opened and the contents—known as the "sponge"—is removed. This presents a pale, yellowish appearance owing to the purity of the gold which it contains. The "sponge" is then smelted with the necessary amount of flux, a substance used to gather up the foreign matter remaining, and forming into a kind of scum which can be easily removed, leaving the pure metal behind. The result of this treatment is a pure lump of gold—990/1000 fine.

But the whole process of recovery is even now not completed. There is still the treatment of the pulp residue to be considered. When leaving the copper plates the pulp is led through troughs to Wilfley concentrating tables. These are composed of wooden frames built upon an inclined plane, and covered with linoleum. Here are affixed a number of riffles, or narrow strips of wood.

The Wilfley tables are continually being shaken and agitated in much about the same manner as is the floor of a threshing machine. The movement is lengthwise, with a distance of about ¾ of an inch, the number of "shakes" to the minute being about 232. The result of this agitation of the pulp is to separate the sulphides of silver as well as other heavy mineral particles from the sands or pulp, the stuff recovered being termed "concentrates," which is sold to the smelters for further treatment. This is the practice at present in force, but Guanajuato mine-managers are proposing to treat their concentrates themselves in future, and thus effect great economies by eliminating entirely the middleman's profit—in the shape of railroad and smelter charges. When this innovation has been—if it ever is—introduced, there will be no intervention between the mine-managers and the banks and mints which buy pure gold. The saving to the mine owners would be considerable.

After leaving the concentrating tables the pulp is delivered to sizing and separating cones. Here the sand and slime are separated, the coarse sand being delivered to a tube-mill and the slime is run into the tanks, where it remains until ready for the cyanide treatment.

In the tube-mill the sand is subjected to a treatment which makes it much finer, when it is again sized in the cone-sizer. It is now delivered to a collecting tank where all the water is drained away. This tank being filled, the gate in the bottom is opened, permitting of the Blaisdell process being applied.

The Blaisdell system, as established at the Peregrina mines, furnishes an automatic means for charging and discharging the eighteen leaching tanks in which sands

GUANAJUATO: RANCH HOUSE ON THE SAN ISIDRO RANCH.

Belonging to the Guanajuato Development Co.

[See page 127.

are treated. The charging is accomplished by means of an apparatus similar to the Butter's distributor, which takes the wet material directly from the collecting tanks and distributes it conveniently, and in a porous condition, in the tanks, without labor of any kind. The discharging machine consists of a special arrangement of harrows working in the tank by means of a large machine, setting upon the tank, and moving backward and forward along the row of tanks on special rails. The harrows throw the sand toward the centre, where they fall through an orifice, previously bored through the centre for that purpose, on to an automatically-moving belt below, which carries them to the tailings stacker, and which deposits them in an adjoining hill in large heaps. The charging of the tanks by this process is so much better than by any other that the leaching process is greatly aided, and a far better percentage of extraction is obtained. By the discharging process, all labor is done away with, and the cost reduced from 10c. (Mex.) per ton to about 2c. (Mex.) per ton.

A more complete description of the Blaisdell system follows on page 147.

The following table showing the total amount of values extracted by the Peregrina method of treatment of its ores, as well as the cost of such treatment, will no doubt prove of interest:

RESULTS OF TREATMENT PROCESS:

Mine Ores:

Saved on plates.....	19.7	per cent. of total value
Saved in concentrates..	24.23	per cent. of total value
Saved from coarse sands	12.94	per cent. of total value
Saved from fine sands..	13.69	per cent. of total value
Saved from slimes.....	23.76	per cent. of total value
Total saving.....	94.32	per cent. of total value

The above results were obtained from large milling tests, and after a thorough preliminary examination. The figures refer to net extraction after allowing $20.00 (say £4) for freight and treatment charges per ton of concentrates. The material assayed per ton (2,000 lbs.) .626 oz. gold and 17.4 oz. silver. Total value—$23.38 (about £4/14).

Dump Ores:

Saved on plates.....	19.00	per cent. of total value
Saved in concentrates..	9.10	per cent. of total value
Saved from coarse sands	14.76	per cent. of total value
Saved from fine sands..	15.55	per cent. of total value
Saved from slimes.....	35.34	per cent. of total value
Total saving.....	93.75	per cent. of total value

These results refer to the material treated, which assayed per ton (2,000 lbs.) .26 oz. gold and 5.52 oz. silver, total value being $8.83 (say, £1/15/6).

Cost of Treatment.

The cost of the milling and treating the ore from the Peregrina mine with the plant at present in hand is as follows:

Power	$0.34
Wear and tear	.25
Cyanide treatment chemicals	.38
Zinc	.05
Labour	.12
Sundries	.10
Administration	.25
Interest on investment	.15
Depreciation	.21
	$1.85

or, say 7s. 9d. per ton.

THE BLAISDELL PROCESS.

The purpose of the Blaisdell System, which is the invention of Mr. W. H. Blaisdell, President of the Blaisdell Company of Los Angeles, California, is to eliminate the great mass of unreliable and unskilled labour heretofore required in the cyanide plants for charging and discharging the sand vats. By this system no manual labour is required from the time the ore leaves the crushers until it reaches the precipitation house, or tailing dump. Although this system was invented and first placed in use but three years ago, it is now handling the product of over 1,000 stamps in the United States, Mexico and South Africa.

Among the plants using it are:
El Oro Mining and Railway Co., Ltd., Mexico,
Cia. Minera Las Dos Estrellas, Mexico,
Black Mountain Mining Co., Mexico,
Peregrina Mining and Milling Co., Mexico,
San Prospero Mining Co., Mexico,
Tonopah Mining Co., of Nevada, U. S. A.,
Chas. Butters and Co., Ltd., U. S. A.,
New Modderfontein G. M. Co., South Africa,
Langlaagte Deep Mines, South Africa,
Knights Deep, South Africa.

The Blaisdell process has effected a great simplification of plant arrangement as well as operation. It dispenses with the necessity for placing the sand-collecting vats on a plane above the sand-leaching vats and the very unsatisfactory construction of superimposed tiers of leachers, so universally used heretofore on the Rand, and in some parts of America. As is shown by the cut which illustrates the sand department of the cyanide plant of the Peregrina Mining & Milling Co. of Guanajuato, the sand collecting and leaching vats are all of the same size, placed on the same level, and in two parallel rows; the four collecting vats are automatically filled by two Blaisdell class W-C Distributors, these machines being an improved patented form of Butter's Distributor, mounted on a swinging crane, so that one distributor serves two vats. (A Butters Distributor works similar to an automatic lawn-sprinkler, which is revolved by the force of the discharged water.)

The mast of the crane is mounted just outside the trackways running along the outside of the two rows of vats, in order to enable the distributor to be swung on

GUANAJUATO: STREAM FEEDING THE NEW RESERVOIR DURING THE DRY SEASON.

Plate 33.] [See page 127.

one side when the excavator has to pass into position for emptying one of the collecting vats.

But one excavator is required for emptying all the vats, collectors as well as leachers. It consists of a steel truss bridge of a trifle greater span than the vat diameter, being supported upon trucks having double flanged-wheels which travel on the trackway, above mentioned. At mid-span of the bridge is a large vertical shaft of solid steel, 8 inches in diameter. The vertical shaft has two diametrically opposite featherways in which feathers slide, fixed in the large bevel-gear at the centre of the bridge deck, and thus is accomplished the revolving motion of the four horizontal arms suspended at the foot of this vertical shaft.

As this shaft revolves, it is automatically lowered by means of the left and right-hand vertical screws, which work in threaded bearings in the large cross-head which supports the vertical shaft, and which is shown near the top of the bridge truss. Suspended from the four horizontal arms are a number of hangers, having solid steel spindles, on which are mounted concave steel discs, such as are used on agricultural harrows. It will be noted that the discs are placed obliquely to the radii of the beams, so that the furrow made by one disc is rolled over towards the center of the vat by the disc on the following arm. This rolling motion gives a minimum of friction, so that the power required for performing the work is very insignificant, being about .075 horse-power per ton excavated. The machine is actuated by small electrical motors which receive current from trolley wires strung along the outside of each row of vats.

For filling the sand-leaching vats, there is required only one distributor. It is a steel truss bridge and is of much simpler design than that required for the excavator. On this bridge is a short belt conveyor which delivers the sand, discharged by means of a travelling tripper on the conveyor running between the two rows of leaching vats, to the centre of the distributor bridge, where the sand falls on to a centrifugal distributing plate, which showers it lightly and uniformly into the vat. This machine uses the same trackway and trolley wires as the excavator, a transfer-table being employed for moving the machines from one row of vats to the other.

There are also the following conveyors: Conveyors Nos. 1 and 4 underneath the two rows of collecting vats and delivering to Conveyor No. 3 via the short cross-conveyors, Nos. 2 and 5. Underneath the two rows of leaching vats are the two reversible conveyors, Nos. 6 and 7, which, when running to the left, return the sand for double treatment to Conveyor No. 3, or, when running to the right, deliver the tailings to the stackings conveyor, No. 8. At the head, or discharge, end of Conveyor No. 8 is a rotating drum or pulley having on it triangular-shaped hard steel beaters, or "batters," and as the tailings are discharged from the conveyor they are thrown some 25 or 30 feet beyond the end of the conveyor by means of this rapidly revolving beater, which is known as the Blaisdell Class N. Tailings Stacker.

The purpose of this machine is to avoid the construction of a high trestle way (such as is quite common on the Rand), for by means of this device the dump is built sufficiently in advance of the conveyor to enable the lat-

ter to be gradually extended outward upon it, and there is required merely a very inexpensive substructure consisting of cross-ties and stringers, for carrying the conveyors' idlers, or pulleys.

To avoid frequent splicing of the conveyor belting, there is introduced near the tail-end of the conveyor an expansion loop, usually about fifty feet between bend-pulleys, which enables the conveyor to be extended for nearly fifty feet, without adding additional belting. The operation of this expansion-loop is very simple, and will be readily understood by anyone familiar with conveyor work.

After the dump has been built on an incline to any desired height by means of the Class N Stacker, described above, an additional conveyor equipped with the same machine is started level at the height so attained. When the new conveyor has been completed to its maximum distance, the Class N Stacker is dispensed with, and a new device known as Class L Stacker is put on this conveyor for the purpose of extending the dump horizontally on a radius equal to the full length of the conveyor. The principle of the Class L Stacker is almost identical with the Class N, the only difference being that the revolving beater, which throws the tailings, is mounted on an automatic reversible travelling tripper. Referring once again to the half-tone cut, the operation of the plant with the machines in the position shown in the drawing, is as follows:—

One of the Class W-C distributors is filling one of the collecting vats; the excavator has moved into position over one of the leaching vats, raised the taper discharge plug at the center of the vat by means of a hoist on the

excavator bridge, thereby creating an opening through which to discharge the vat contents on to Conveyor No. 7 below. The travelling chute or loading hopper over Conveyor No. 7 has been placed in position under the centre of the vat-opening, and Conveyors Nos. 7, 5, 3 have been started by means of electrical switches on a conveniently-located switchboard. The Class Z-S Distributor is in position over the leaching vat to be filled, and the movable tripper on Conveyor No. 3 is situated so as to properly discharge the load of Conveyor No. 3 on to the cross-conveyor of Class Z-S Distributor. The excavator is then started and the sand is automatically transferred for double treatment at the rate of one hundred tons per hour, and at a cost of about half a cent per ton (one farthing).

For discharging and stacking on to the dump, Conveyor 7 or 6, running to the right, is employed together with Conveyor 8, the stacker and the excavator.

For transferring a collecting-vat charge to a leaching vat, the excavator, Conveyors 1, 2, 3 or 4, 5, 3 and the Class Z-S Distributor, are used.

After starting the equipment in any of these operations, it runs automatically, and should the operator fail to return at the proper time it will automatically stop.

GUANAJUATO: SOME OF THE AMERICAN OAK TIMBER, OF WHICH AN ABUNDANCE EXISTS UPON THE SAN ISIDRO RANCH.

Belonging to the Guanajuato Development Co.

[Plate 24.]

Chapter XI.

The Mineral Development Company.—Capital and Directorate.—The Nueva Luz.—The Mother Lode and the Nopal Veins.—The Vein Systems.—Former Erratic Workings.—Bookkeeping in the Olden Days.—The Government's Share; How was it Computed?—The Shaft.—Its Cost and Time of Construction.—The La Torre Mines.—Bright Prospects Ahead.—The Work of the Future.—The La Sorda, and its Present Development.—The La Planta.

THE Mineral Development Company of Guanajuato and New York is composed of a number of gentlemen nearly all of whom are members—and distinguished members—of the mining or kindred engineering professions in the United States. It is but seldom that one finds a financial syndicate composed almost exclusively of such professional men, and it should prove of considerable benefit to the mining district generally, for many reasons.

The Mineral Development Company acts up to its name, for it actively "develops" the properties which it acquired by means of its own money, through the available professional knowledge possessed by its own members, and upon a system which one may accept for granted is the best for the purposes.

The capital of the Development Company is $1,000,000 (say £200,000), of which less than $600,000 has been issued. It is not intended to increase this issue unless the prospects of the various virgin properties warrant the company in extending their operations. The shares are of a par value of $50.00, and there is but one

class in issue. The Directors are as follows: President, Mr. Theodore Dwight, M. A. I. M. M. and I. and S. I.; Vice-Presidents, Captain W. Murdoch Wiley and R. V. Norris; L. H. Taylor, Jr.; Mr. J. P. Whitney; Major Charles E. Lydecker; Dr. Joseph Struthers; Mr. Virdon and Mr. J. E. Van Doren, Secretary and Treasurer. The offices of the company are at 99 John street, New York; Dover, Delaware, and at the mines at Nueva Luz, Guanajuato, Mexico. Mr. H. H. Miller, E. M., is Resident Manager.

Certainly the choice of properties made as a start has been a singularly happy one. Although they have their way yet to make, and their history is as yet practically an unopened book, the prospects of the company's holdings are sufficiently encouraging; and the splendid reputation of their immediate neighbors is so suggestive, that no fear need be entertained of the ultimate results. As will be seen, the ground occupied by the Mineral Development Company is in part historic, on account of what has been produced all around, there being a record of over $800,000,000 to the credit of the Mother Vein at Guanajuato and which passes through the properties of the company. They have this also to aid them, the fact that this truly remarkable vein of ore has never failed, in all the 300 years and more that it has been worked, to yield paying ore in return for a well conceived and intelligently carried out system of development. The company are the owners of the following properties: The Nueva Luz, about one mile distant from the City of Guanajuato; the La Torre mines, which are about five miles distant, in addition to La Planta and La Sorda, the former on the Mother Vein and the latter on the Sierra

system. The first named (Nueva Luz) covers an area of 72 acres, and the second (La Torre) has a superficial area of about 90 acres.

The amount of ground which is occupied by Nueva Luz mine, as already stated, is some 72 acres, situated in the angle between the Valenciana and the Nopal, as also mentioned. On the Nueva Luz the rich ore bodies dip directly from the Valenciana, entering it at an angle of 45 degrees, and at a depth of 1,950 feet below the surface at a point opposite the general shaft of the Valenciana. The ore bodies of the Mother Lode continue down, and have been stoped almost to a side line of the Nueva Luz, say about 150 feet. As far as human judgment goes, and in accordance with all reasonable supposition, the same rich ore bodies must continue down and into Nueva Luz ground.

Then, again, there are the Nopal veins which run directly through the property of Nueva Luz, these same veins having yielded ore as far down as they have been followed on the latter company's ground about 700-800 feet and representing conditions—and consequently future prospects of richness—identical with those of the Nopal mine. Between the years 1860 and 1880 the Nopal mine, by the aid of horse whims and the patio process, produced over eight million dollars in silver and gold, following the ore shoots to depths of 700 feet below this smaller vein to reach the limits of the surface. It required less depth in profitable work with the old primitive mining methods than in the larger and richer Mother Lode mines.

As a matter of fact, there are three different and distinct systems of veins known to traverse the Nueva Luz

ground. The first, the Mother Lode system, to which the Nopal vein belongs, runs from northwest to southeast and dips southwest (from N. 45 degrees W. to S. 45 degrees S. W.) The Mother Lode, on the other hand, is itself one of three parallel vein systems which course in a northwest and southwest direction, being well defined and having huge outcroppings which may be traced with ease for many miles. In a linear extent of 10,000 feet this lode has been productive, its richest output having been within 6,500 feet along it.

The second system of veins on the Nueva Luz is a transverse one, running from southwest to northeast and dipping southeast. These veins strike across the first named at almost right angles, having on them the veins of Mañon and Nueva Luz, and upon which the tunnels of the same names are run, and of which mention is made later on.

The third system is that to which the Flat (of Nueva Luz) and the Santa Inez (of the Nopal) belong.

The first ore struck was on the ground at the intersection of the Mañon vein with the cross-vein of the second system, west of the Cañada de San Matias. Upon its discovery, this ore was followed down until the workers were driven out by the water, and, although a small one only, the shoot yielded some very promising ore. How far the ore goes at present is unknown, as the water renders it impossible to make a proper investigation.

The ground here seems to have been worked in a very erratic manner by its owner, one Manuel Godoy. He appears to have preserved no records of what work he did or of what it cost him to do it, very unlike the majority of the mine owners of the Guanajuato and other

GUANAJUATO: BASIN TO BE SUBMERGED BEHIND DAM, SAN ISIDRO RANCH.

Plate 35.]

[See page 128.

Mexican mining districts, who kept voluminous records of their transactions, not always reliable, perhaps, since some of them, at least, maintained one set of books for their own information and another for that of the Government officials, who based the amount of taxation upon what they were shown in the books which were presented for their inspection. I have, however, seen records going back further than a century, and kept in a most neat and business like manner; who can say, however, at this stage —and who then, for the matter of that—that the figures provided are reliable? But Señor Godoy kept no accounts at all, and it would be interesting to know how he managed to square-up with the government of his day.

The Nopal vein has yielded some good ore, which has been worked to a length of 1,000 feet. The owners pursued methods of their own, there being no systematic manner of working the vein or making a continuous stope, large patches of unbroken ground being left between the various workings. However, the Nopal vein was followed into the property of Nueva Luz, and a quantity of ore taken out for which the trespassers had to pay $14,000 as damages. Thereafter a strong iron gate was put up at the junction of the two properties underground, which marked the boundary-line.

One particularly favorable feature possessed by the Nopal vein is its persistency in strike and output. The outcrops are clearly visible throughout the territory of the Nopal and that of the Nueva Luz mines, and for a length of more than a mile. Reliable authorities consider that from these surface indications on the last named mine, it is probable that these veins will make ore bodies in depth of that mine similar—or practically

similar—to those formed in them on the Nopal mine. It is worthy of note that the highest values made were those almost 1,000 feet distant from the Nopal line, the ore at this point being rich in gold.

In deciding to develop the Nueva Luz property, very careful plans were prepared after a thorough examination of the ground had been made by more than one competent mining engineer. The outcome of the investigation was the decision to sink a deep shaft intended to cut the Valenciana ore shoot in a depth below the old workings. Here I may mention that the Valenciana mine itself has a shaft down 1,800 feet vertically, and this has a diameter of 32 feet. The shaft being carried a little further down—some seven feet, making the total depth 1,807 feet—was abandoned by the then owners on account of the cost of unwatering by means of the inefficient methods then available.

The Mineral Development Company intend continuing the work where the previous owners left off. There are ore bodies going, as has been proved beyond any reasonable doubt, into the Nueva Luz ground, and this company's shaft will, as I have said, cut the Valenciana ore shoot. The shaft, originally measuring 11 x 11 feet, has been converted into a modern 3-compartment shaft measuring 5 x 16 feet. It is already down 416 feet, and the total depth to which it is anticipated the shaft will go is 2,920 feet. This will be at the centre and at the lowest available point on the Nueva Luz ground. As the shaft goes down it will cut the veins of the Nopal group as well as the Santa Inez vein, this latter being met with at about 800 feet below the surface. Cross-cuts and drifts will then be run out at the most appropriate points, in or-

der to develop these several well-proven veins. The shaft, as left by the former owners, was in good condition, and has been furnished now with a 50 horse-power double drum electric hoist, the shaft being actively proceeded with day and night.

This shaft will probably be used in connection with the Nopal system of veins, and an additional one sunk for the purpose of working the Mother Vein, a cross cut being planned from the 2,300 foot level, equivalent to about 2,500 feet when compared with the Valenciana, as the collar is about 200 feet lower than the latter.

The character of the rock encountered is favorable for working, since it is not hard drilling and stands well without the necessity of timbering. A modern electric pump is capable of handling all the water which the shaft may make. To reach the Mother Lode vein will require about two years continual work. The total cost will probably be about $200,000 (Mex.), or say £20,000.

I now propose to speak of the Mineral Development Company's second important mining properties known as the La Torre mines, which are situated about five miles southeast of the City of Guanajuato. The principal vein passing through the property is once again the celebrated Mother Vein. The greatest bonanzas ever encountered in the Mother Vein were those at the intersection of the hanging wall veins. In this La Torre property, there unquestionably intersects, judging from its direct course, the Carmen gold vein, which is now in bonanza on a property within half a mile distant from the La Torre mines. This Carmen mine was lately sold in New York, and the company is in active operation to-day, rapidly blocking out enormous quantities of rich gold ore.

The La Torre mines cover a superficial area of about 90 acres, the claim running about 4,000 feet (almost a mile) on the strike of the Mother Vein, and having a width, and consequently a vertical depth on the vein, of from 1,000 to 1,500 feet (the vein dipping 45 degrees from the horizontal). The surface is undulating, there being a gradual rise towards the south end of the claim, and the ground slopes to the southwest with the dip of the vein, thus affording opportunities for shafts sunk cutting the vein on the dip with comparatively slight amount of sinking in good depth, as compared to the outcrop of the vein. The outcropping of the Mother Vein is distinctly visible to the eye through the entire claim, presenting an impressive appearance, some 40 or 50 feet in width. Sampling of the outcrop shows the vein to be mineralized, even at surface (which is quite rare for this vein), but no development work has ever been done, and the property presents an absolutely virgin piece of ground.

For two centuries the work on this Mother Vein was confined to the central group of mines, comprising those between, and including, the Valenciana and Sirena. During the 19th century, however, the development work was pushed south and the Cedro mines opened up, yielding many millions. These mines are now in operation, owned by a powerful American corporation, and are producing handsome profits. Later, the Cardones mines, which are still further to the south, gave a bonanza of high-grade gold ores; and, still further to the south, the La Union Tunnel (immediately adjoining the La Torre mines to the north) has been opened up within the past ten years with the result of now yielding

SHAFT AND ELECTRIC HOIST AT THE NUEVA LUZ MINE.

Belonging to the Mineral Development Co., Guanajuato.

Plate 36.] [See page 160.

very good profits both in gold and silver, although, as yet, only partially developed. It has been worked in the slowest manner, being owned and controlled by one man, who is not a miner, his work consisting principally of a tunnel on the vein and from this tunnel level, two winzes on pay ore, in the sinking of which there was an actual production for 21 months (as per copy of all mill returns) of 2,469 metric tons, having an average assay value of 31 ounces silver and 28/100 ounces gold per ton. The average value per ton was $21.10 U. S. Cy. for the full width of the pay ore, which is about 8 feet, although the width of the entire vein in this property, as proved by several crosscuts at the tunnel level, is 60 feet from wall to wall. All of this ore came from only two parallel winzes sunk below tunnel level, the greatest depth of which was 60 meters. At the point at which this mineral was found, no crosscuts had then been made towards the footwall, all the ore extracted being from the hanging wall. The grade of the ore was materially increasing in value with depth, notably so in its gold value. This was the condition of the La Union Tunnel about January 1, 1902.

All this property is immediately adjoining the La Torre mines on the same vein. Beyond any question this vein continues to be mineralized through the La Torre property. The work to be done in exploring the property consists of a tunnel to be run in from the hanging wall, to cut the vein at an approximate depth of 200 feet below surface. This will cost about $3,000 Mexican currency; various inclines investigating the vein at favorable points should not cost more than $3,000 Mexican currency in addition. With the information gained

from these explorations a shaft could be sunk to 400 feet vertical depth, which would cut the vein on its dip 600 feet below its outcrop, and this could be done on the remaining $14,000 of the $20,000 Mexican currency which must be spent on the development of the property under the terms of sale. One or two cheap buildings, a horse whim, cable and horses, are included in the above estimate of expending $20,000 Mexican currency.

The Mineral Development Company has done no work on the La Torre property since January, 1905, merely proving the vein for from 500 to 600 feet.

La Sorda mine is a virgin prospect which the company is now exploring. It is on the Sierra system, and while the openings have not yet passed through the leached ground, stringers running very high in values have been encountered. The three parallel veins outcropping on this property are strongly defined, and are of considerable width. Until further development has taken place, little more can be said. The property embraces 100 pertenencias, or say 100 hectares=247 acres. The La Planta property belonging to the same company is at present also undeveloped.

The Development Company prides itself upon the fact that it has not found it necessary to issue any kind of advertising matter nor yet a circular for the purpose of soliciting subscriptions among the investing public. Several applications from would-be investors have, it is said, on the other hand been declined, such additional subscriptions as have been accepted being those of the original organizers and their friends, mostly belonging to the engineering professions.

Chapter XII.

The Guanajuato Amalgamated Gold Mines.—Some Celebrated Properties.—The Company's Directorate and Capital.—The Old Workings.—Mexican Methods.—The New Management.—The Shafts.—Geological Peculiarities.—Enormous Ore Bodies.—Samples and Their Yield.—Colossal Dumps and Their Values.—Underground Work.—What Has Been Done.—Future Developments.—Dangerous Working.—Clean Record of "No Accidents," to Date.—Some Heavy Work Ahead.—Capable and Efficient Management.

THE La Luz district of Guanajuato is one of the most famous and historically interesting in the whole camp. In 1842 the great "bonanza" commenced and continued for a period of several consecutive years. Hundreds of miners, with the usual shifting and rolling-stone propensities of their kind, left the other districts for La Luz, and for a few months, at least, the paucity of labor was a serious matter for the rest of the Guanajuato mines. The town of La Luz became a beehive of industry and the liveliest in the State, the population growing from a mere handful to a formidable army of over 20,000 souls in a few months' time. The annual output from this rich district amounted to several millions of dollars. The town to-day is still one of the most picturesque that I have seen in the whole of Mexico, with its exteriorally beautiful old church, and occupies a position which practically overlooks the entire country. From the full panoramic picture which I give of the country, it will be seen that the position of La Luz is almost unique. But the glories of La Luz

commenced to wane when the star of the Rul mines began to rise, and in or about the year 1860 one heard little more of La Luz, but nevertheless it continued to distinguish itself as a good producer for some time to come.

The names of "Jesus Maria," "Villarino," "Sangre de Cristo," "Providencia," "Remedios" and "Dolores" are all historic names, and these mines are to-day being one by one redeveloped and opened up gradually by the Amalgamated Gold Mines Company of Guanajuato, which owns them all. The "Jesus Maria" in particular has a remarkable record as a producer, having probably yielded the greatest amount of value in proportion to its size of any mine in Mexico. The group worked by this company is known under the title of "Negociacion de la Paz," and from first to last the mines enumerated above are said to have produced something like $25,000,000, or, say, £5,000,000.

The Amalgamated Gold Mines Company is an American corporation, promoted and financed by the Colonial Securities Company of New York, and having its head offices also in that city. The directorate is composed as follows: Mr. Albert J. Adams, President; Mr. Richard W. Cannon, Vice-President; Mr. George Karsch, Treasurer and Secretary. The management at La Luz consists of Mr. Lawrence P. Adams, Manager in Chief; Mr. John F. Smith, Superintendent; Mr. E. Harris, Chief Miner, and Mr. V. B. Sherrod as Constructing and Mining Engineer.

The company's capital is $3,000,000, divided as follows: Purchasing and financing the mines $1,650,000; unissued stock used for working capital, &c., $1,350,000. It is hoped that in due course of time the ore in sight and

LA TORRE MINE.

Property of the Mineral Development Co., Guanajuato.

Plate 37.] [See page 162.

ready for treatment will yield more than $5,000,000, but this is exclusive of the ore below the present level. The estimate is made up as follows:

Ore dumps, amounting to 250,000 tons....	$875,000
Mine fillings, 250,000 tons.....	1,625,000
Ore in sight, 300,000 tons @ $15.00 per ton	3,300,000
Total:	$5,800,000
Less contingency @ 10%	580,000
Net total:	$5,220,000

These profits can only commence to accumulate when the mill, now being constructed, is completed. This will be about the end of the current year, the work being extremely well and substantially carried out. In fact I have not seen better constructional work at any mine in the world than that being put in at the Jesus Maria mine at La Luz.

The machinery used by the former owners was not of a very valuable or useful nature, and an entirely new installation is being made. Within recent years a small steam hoist was installed, and still more recently an electric hoist of 30 horse-power was put in at the Villarino shaft; but this did not help matters much, for the best stopes were far below the bottom of the Villarino shaft, and the ore, waste and water still had to be handled by hand labor up more than 200 feet of ladders before the hoist could be of service.

The ground is held by mining titles from the Mexican Government, the following being a list of the claims and their areas:

I.	Title No. 1451 for La Paz Mine containing	14.2572 Hectares
II.	Title No. 2562 for La Paz y Anexas, containing....	13.6270 Hectares
III.	Title No. 3590 for La Paz y Anexas, containing....	18.1520 Hectares
	Total:	46.0362 Hectares

In addition to the above, 17 hectares have been recently denounced to cover the dip of the vein. This claim, known as "El Atleta," is still pending in the Government Mining Agency. The present management has already done some good work. Five shafts have been sunk on the property, three of which are now open, and any one of which could be made into a working shaft for modern hoisting methods. Of these three, that called "Providencia" is about 10 feet in diameter and 500 feet deep. Another called "Jesus Maria" is about 12 feet in diameter and 850 feet deep, and this is the best situated for operating and developing the mine in connection with a modern milling plant. A third, known as "Villarino," is about 12 feet in diameter and 600 feet deep, and also excellently located for use as an auxiliary shaft, should one be required. There are a great many drifts, crosscuts, etc., driven in the usual Mexican fashion. In addition to these, there is the usual Mexican equipment of horse whims, hand tools, rails, cars, houses, etc., a good deal of which can be profitably utilized in modernizing the equipment.

(NOTE.—A hectare is 10,000 square meters, or 2.471 acres; 46.0362 hectares being equal to 113.7555 acres.)

A few words concerning the geological formation of this country may be useful. In brief, the veins are strong fissures in igneous rocks called diorite, the diorite lying within a large field of andesite, porphyry, etc. The vein filling is quartz strongly impregnated with calcite, which in spots amounts to over 15 per cent. of the gangue. The silver occurs principally as the simple sulphides, occasionally associated with antimony. The gold is found in small particles of pyrites scattered throughout the gangue and as free gold, rather finely divided. The principal vein system is formed by the junction of the two veins, known as "La Luz" vein and "Los Plateros" vein. and dips to the west at an angle of about 50 degrees,

The La Luz vein has a strike of about N. 12 degrees W. and dips to the west at an angle of about 57 degrees. The Plateros vein has a strike of about N. 40 degrees W., forming a junction with La Luz vein at a distance of about 1,000 feet south of the north-end lines of the property, the junction at surface being between Providencia and Jesus Maria. Owing to the difference between the dip and the strike of the two veins, the junction rakes to the south on the dip, and at a point about 800 feet below the surface the junction is about 400 feet farther south than at the surface. The largest ore bodies have been formed near or at this intersection, and there is every reason to expect that this junction will continue to supply large quantities of ore to a much greater depth than has yet been attained in this district. From this junction north, the La Luz vein passes successively through "Los Locos," "La Trinidad," "El Refugio," and La Luz group of mines, which have had a combined production of $240,000,000, exclusive of La Paz group.

La Luz vein is unknown south of this junction, and within La Paz boundaries, but is supposed to be first seen to the south in the adjoining mine called "Santo Nino." The Plateros vein is but little known outside of La Paz boundaries, although it has produced immense quantities of high-grade silver ores from within La Paz ground. It is the more recently formed of the two veins, and probably "faulted" La Luz vein in crossing it. The gangue from Plateros vein is remarkably high in calcite. There are other veins on the property, most of which are probably secondary fissures uniting with the principal veins near the junction. These veins have yielded good ore bodies in places; although they have been but little explored.

Naturally all the good ore in the upper workings of the ore bodies so far discovered has been stoped out. This is generally the case in Mexico, as the Mexican system of mining does not include the blocking out of ore reserves. The ore stoped from these workings was roughly sorted under ground, leaving the lower grade ore as fillings in the old stopes, and further sorted by hand, breaking and washing after reaching the surface. The result of this system of mining is that large quantities of low grade, but profitable, ore are lying in the old stopes, and large dumps of the same material are lying on the surface. This material without further sorting can be treated at a good profit by modern methods.

The Providencia shaft, located near the north end of the property, is the most recent of any of the shafts, having been sunk since 1898. It was sunk to develop the La Luz vein on the north end of the property, and is

GUANAJUATO AMALGAMATED GOLD MINES CO.

Jésus Maria Mine, La Luz, showing some of the improvements being installed March 1, 1906.

in the neighborhood of 600 feet in depth. The La Luz vein at this end of the mine passes out of La Paz ground and into that of Los Locos ground on the dip at a vertical depth of approximately 750 feet. At a depth of about 2,000 feet the vein again passes out of Los Locos and into La Paz ground, the former being a small area of ground lying partially within the boundaries of La Paz property. At a short distance farther south, however, the La Paz ground covers the entire dip of the vein to a depth of a little more than 2,000 feet and the dip is still further protected by claims, the titles to which are now pending in the Government Departmento de Fomento. Something like 800 feet of drifting and exploring have been done in the territory adjacent to this shaft, with practically no stoping. An average of four samples taken from a dump of 15,000 tons of ore mined from these workings yielded the following results: Silver, $2.48; gold, $2.34; making a total of $4.82—say, 19 s. per metric ton. The ore in this dump having been sorted before having been put on the dump, does not represent the average value of the ore taken from drifting and development work in this portion of the mine. An average of six samples representing the width of the vein in this part of the mine gave the following results: Width of vein, 4.7 feet; silver, $2.21; gold, $5.68; making a total of $7.89, say £1/11 per metric ton.

The Jesus Maria shaft is a vertical shaft which is sunk in the hanging wall, and which cuts the La Luz and Plateros veins on their dip at approximately 700 feet below the collar of the shaft. The shaft passes through the veins at their intersection with each other, and at a point

where the ore body was wide. In later years, the Mexicans stoped out this ore as far as possible, but they left no shaft pillars, with the result that the shaft has caved in at this point, and the workings in its neighborhood are generally inaccessible. The ore chute formed at this junction was about 600 feet in length, and in that portion which is still accessible it averages 9.8 feet in width. The average of 27 samples taken across the vein at various parts of these workings gave the following results: Width of vein, 9.8 feet; silver, $2.98; gold, $5.60; making a total of $8.50 (say £1/16) per metric ton, There are three levels in the bottom of this shaft which are now filled with water and inaccessible; but the sampling showed no change in values between the upper and lowest accessible levels of this ore body. It is claimed by all the old employes of the former operators that the width and values are maintained in the lowest levels.

The Villarino shaft is located about 328 meters south of the Jesus Maria shaft, and intersects the vein at a point south of the large ore chute above described. The workings tributary to this shaft were formerly known as "Sangre de Cristo," and the ore was formerly hoisted through the old San Antonio shaft. The ore body in the upper workings of the mine is distinct, and separated from the Jesus Maria ore chute by a barren streak in the vein. As this ore chute is at right angles to the strike of the vein, it unites with the Jesus Maria ore chute at approximately 500 feet below surface, forming one continuous ore body about 1,000 feet in length, and extending both north and south from the junction of the two veins. Twenty-six samples taken across the

vein in the various accessible drifts and winzes gave the following results: Width of vein, 8.6 feet; silver, $4.75; gold, $3.32; making a total of $8.07 (£1/12) per metric ton.

The Plateros vein north of the junction contained a greater percentage of its values in silver than any other portion of the mine, and for that reason was more amenable to hand sorting and treatment by the old patio process. It has, therefore, been completely worked out to water level, and the workings are now filled and inaccessible. It is believed that in the drifts below water level the vein carries very good values at every point.

Practically all of the old stopes at or near the junction ore body are filled with broken ore remaining as waste after the preliminary underground sorting. These workings are accessible only in those places where drifts have recently been spiled through the old caves, and even a rough estimate of tonnage is impossible. An average of 32 samples taken from points now accessible gave the following results: Silver, $5.15; gold, $5.31; making a total of $10.46 per metric ton. Judging from the dimensions of those parts of the vein now accessible, a conservative estimate would place the tonnage at 200,000 metric tons. There is but little doubt that practically all of this ore can be cheaply and safely obtained, and without doubt large quantities of ore will be found still standing in these stopes, as it was the practice of the Mexicans to mine the better grade of ore only, and to leave standing that portion of the vein which was found of too low grade for the old patio treatment.

There are three huge dumps on this company's property and which are comparatively easy to measure and sample, and one other very much older dump. The Jesus Maria Dump was estimated by cross sectioning and sampling, the following being an average of 54 samples: Tonnage, 260,000; silver, $2.70; gold, $3.60; making a total of $6.30 per metric ton. The Villarino Dump contains 20,000 tons, the average of seven samples being as follows: Silver, $2.05; gold, $2.36; total, $4.41 per metric ton. The Providencia Dump has a tonnage of 15,000; average of 4 samples —silver, $2.48; gold, $2.34; making a total of $4.82 per metric ton. The Remedios Dump has a tonnage of 12,000; average of 4 samples—silver, $2.61; gold, $1.91; making a total of $4.52 per metric ton. The total tonnage of broken ore, not including the Villarino, Providencia, or Remedios Dumps, is as follows:

Fillings, 200,000 tons at $10.46.....	$2,092,000.00
Dumps, 260,000 tons at 6.30.....	1,638,000.00
Total, 460,000 tons at 8.108.....	$3,730,000.00

Approximately 40 per cent. of the above values is in silver and 60 per cent. in gold. These ores have been successfully treated by a combination of cyaniding and concentration at the Purisima cyanide plant (a small custom mill in Guanajuato), and experimental tests on a laboratory scale have confirmed the above statement, giving an extraction by cyaniding alone of over 70 per cent. of the silver and 90 per cent. of the gold, or an extraction of 82 per cent. of the total values. This extraction can undoubtedly be increased to 90 per cent. of the total values by the use of amalgamating plates to

GUANAJUATO AMALGAMATED GOLD MINES CO.

Dump of Jesus Maria Mine, showing improvements being installed March 1, 1906.

remove the coarse gold, and of concentrators to remove the coarser sulphides before cyaniding. Calculating upon the above basis, the following is an estimate of the profit that ought to be made in the treatment of the dumps and fillings:

Cost of drawing, hoisting and tramming of 200,000 tons of fillings at 40c. per ton	$ 80,000.00
Crushing, milling and cyaniding at $2.25 per ton	450,000.00
Total cost of treating fillings.	$530,000.00

Relying upon a total recovery of 85 per cent. of the gross values, there would be recovered in bullion from these fillings $1,778,200.00, leaving a net profit from the treatment of the mine fillings of $1,248,200.00 (say roughly £250,000).

Cost of loading and tramming 260,000 tons from dump to mill at 20c. per ton	$52,000.00
Crushing, milling and cyaniding at $2.25	585,000.00
Total cost of treating dump.....	$637,000.00

A recovery of 85 per cent. of the gross value of this dump should produce in bullion $1,492,300.00, leaving a net profit of $855,300.00, making a total net profit from the treatment of dump and mine fillings of $2,103,500.00 (£420,700).

The first underground work of importance undertaken was the timbering of the Jesus Maria shaft, on which steady progress has been made on the day shift only, and has now reached a point 120 meters from surface. In traversing this distance, two large caves had to be contended with; their measurements being ap-

proximately 75 x 40 x 20 feet and 130 x 30 x 18 feet, which, after deducting measurement of displacement of timber, will require about 100,000 cubic feet of filling. This filling is now being done with débris from the surface, which is conveyed down the shaft through a series of wood launders or boxes joined together in 12-foot lengths. These two caves proved to be large, soft decomposed dioritic porphyry dikes, having approximately the same strike and dip as the quartz veins, and the water they carry in the wet season being undoubtedly the chief agent in making these caves their present dimensions. The accomplishment of this work down to the 120 meter point without a mishap of any kind is decidedly a matter for congratulation, as it was a very dangerous piece of work on account of the loose character of the ground. It will continue to prove dangerous moreover until the filling is completed.

Work has been for some time past going on at various points on the San Lucas level (this is about 230 meters from the surface), the most important being the opening up of the San Miguel winze, situated about 90 meters south of the Jesus Maria shaft, to the dimensions of a three-compartment incline shaft on the dip of the vein. Stoping operations are being conducted at two different points, one on the north side 15 meters below the San Lucas level, and the other on the south side 35 meters below the same point, close to water level. The dimensions of the three compartments will be, two for hoisting 4 x 5 feet, and the other 3 x 5 feet for ladder way. This shaft, timbered to the San Lucas level with hoist and pump installed, will dominate all development work below water level, and will undoubtedly open up a large

body of pay ore, as the average value of rock broken from both stopes is worth $20.00 per ton (£4), with an average width of 2 meters 50 cm.

The drift north on the San Lucas level terminated at a point about 20 meters north from mouth of crosscut leading to the Jesus Maria shaft (this crosscut showing extensive old workings that are filled in), and as samples taken from face of drift show that it was practically in waste, a crosscut was commenced to locate the ore body corresponding with the old workings in crosscut leading to shaft. Within 2 meters the old workings were in evidence, and the drift was commenced immediately on the hanging wall from the face of the old drift and is being driven obliquely toward the hanging wall across the line of vein, so as to cut the vein about 5 meters further north, and determine how far north these old workings extend. A winze was also commenced on the San Félipe level (which is about 20 meters above the San Lucas level) at a point north from face of the drift North San Lucas; this winze and drift will eventually communicate, and as the winze is apparently in virgin ground, and the broken rock assays $22.00 gold to the ton, it will open up in a good body of pay ore. Various raises at points where pay rock is in evidence in pillars and fillings have been commenced, and where chutes will be installed to facilitate the extraction of ore to the shaft.

The collar of the Villarino shaft has been re-timbered, also the landing stage at the San Lucas level, and it is now ready to handle all material and machinery for the new incline shaft.

The whole system of working is extremely well thought out and as well executed. Certainly the properties of the Guanajuato Amalgamated Gold Mines Company are likely to suffer nothing from lack of efficient and conscientious management, of which as a whole it would be difficult to speak too highly.

Chapter XIII.

Some Mines with a Brilliant Past and a Promising Future.—The San Cayetana.—A Remarkable Tunnel.—The Future Working and Its Probable Cost.—The Pabellon Mine, a Once Famous Producer.—Thirteen Years' Production.—The Union of Constancia.—Another Big Tunnel.—Some Future Exploration Work.—The Tajo de Dolores Mine.—The Celebrated Tajo Vein.—Twenty Years' Production.—Refugio.—Bolanitos.—El Cubo.

AMONG the many famous mines in the Guanajuato Camp with a brilliant future assured under a vigorous and a modern system of handling, may be mentioned the San Cayetana. Its history goes back to a period considerably exceeding eighty years, and since a complete—or at least a very full—set of the mines books still exist and are in a state of good preservation, the ambitious and industrious student could scarcely find a more promising field than this for his labors.

During the past five or six years, several fractional claims have been denounced in the locality with the idea of consolidating and making one complete block of the property, which up till then had not been attempted, many small and insignificant interests being held in the scattered directions. A vast amount of good development work has been done on this ground during the past half a century including the construction of a remarkably long tunnel measuring 3,035 meters, and which still remains in excellent condition, proving that the former owners, although slow in their methods, were usually

sure and did not skimp their work. This tunnel took nearly 19 years to complete.

The San Cayetano Tunnel was commenced in June, 1862. It has a total length of 3,140 meters, 10,299 feet, exclusive of the branches, which have an additional length of 3,540, or a total of 6,680 metres, or 21,910 feet. The tunnel has a grade of 1 in 120. The dimensions vary considerably from 8 x 8 feet to the size of a railway tunnel, viz., 12 x 18 feet. For the greater part of its length the tunnel is a drift following the San Antonio vein. When first started it was only of small dimensions and the boreholes were drilled by steel pointed iron rods, but when the subsequent developments demonstrated that its dimensions were not sufficiently wide, it was widened out for its whole length to the Buenos Ayres shaft. This is proved by the numerous steel-drilled boreholes, pointing towards the entrance. Under great difficulties, on account of the bad air, the first shaft (Buenos Ayres) located 500 meters from the entrance to the tunnel, was reached, and work was then proceeded with for a time and with but little difficulty. It had occupied almost ten years to proceed thus far; and records show that two years later, namely, 1874, the tunnel had reached a length of 800 meters (2,624 feet).

For some reason unknown, the tunnel was not made in a straight line in the first instance, probably on account of searching for a vein which at the time the borers failed to find, but which they discovered later in another direction. Although the tunnel was bored in an accurate direction, there was a miscalculation in regard to the level which, when the two ends came together, was found to vary by some ten feet more or less. This was overcome

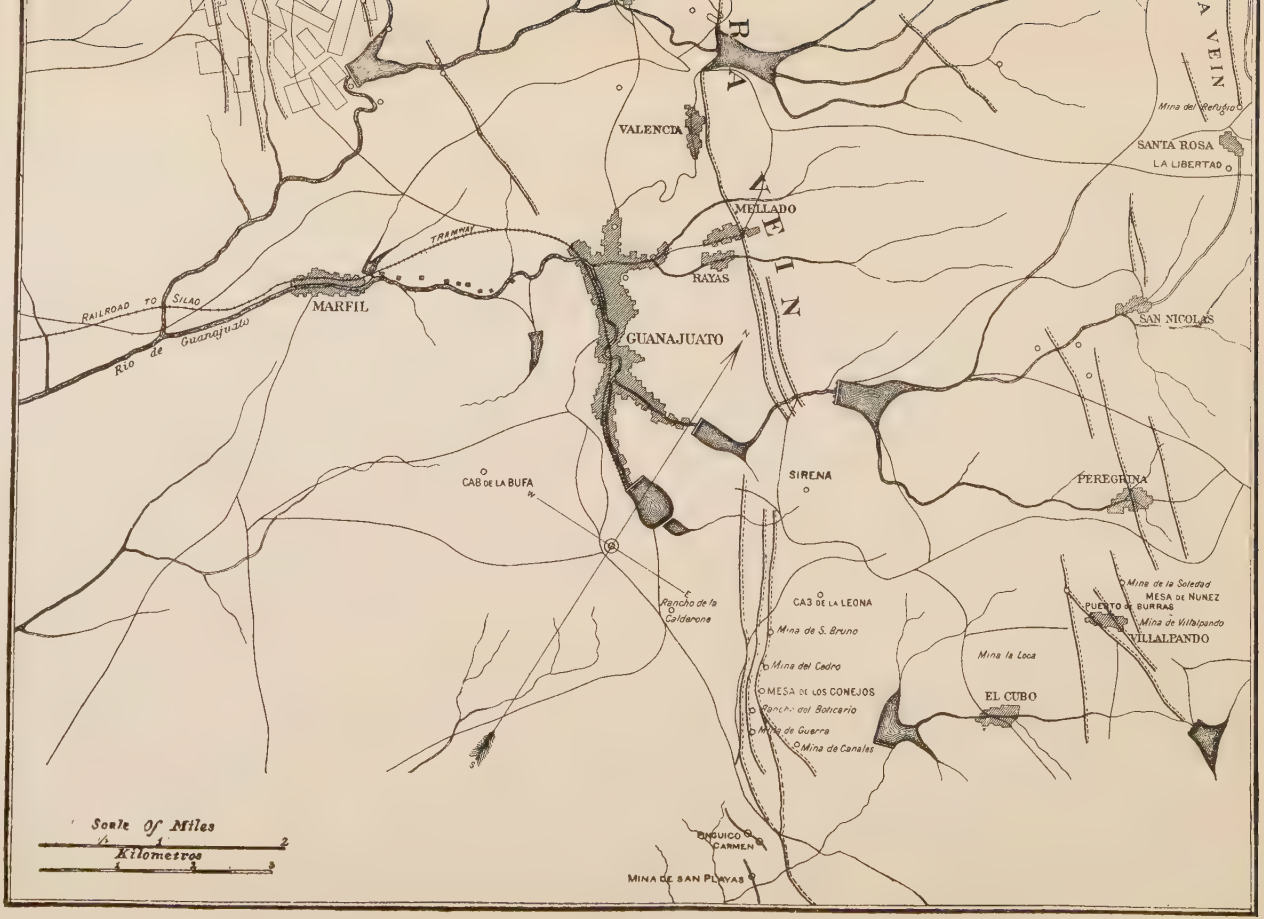

VALENCIA
MELLADO
RAYAS
TRAMWAY
RAILROAD TO SILAO
MARFIL
Rio de Guanajuato
GUANAJUATO
CAB DE LA BUFA
Rancho de la Calderone
SIRENA
CAB DE LA LEONA
Mina de S. Bruno
Mina del Cedro
MESA DE LOS CONEJOS
Rancho del Boticario
Mina de Guerra
Mina de Canales
EL CUBO
Mina la Loca
PEREGRINA
Mina de la Soledad
MESA DE NUÑEZ
PUERTO DE BURRAS
Mina de Villalpando
VILLALPANDO
SAN NICOLAS
SANTA ROSA
LA LIBERTAD
Mina del Refugio
CINQUICO
CARMEN
MINA DE SAN PLAYAS
Scale of Miles
Kilometros

Plate 40.]

by lowering the floor of the part which was too high, the gradient being only 1 in 120, or less than 1 per cent. But work was again seriously interfered with by the continuation of the bad air, and eventually a vertical masonry wall had to be constructed in the tunnel to split the air current and better ventilate the tunnel. This proved successful.

It was on the 29th of July, 1876, that communication was first established, and the tunnel then had a total length of 1,300 meters (3,980 feet), of which 500 have been completed during the last two years. Fourteen years had elapsed since the work was commenced in 1862. Enormous difficulties had been encountered from the beginning and pluckily overcome. Great patience and pertinacity had been evinced upon the part of the management, and the shareholders had shown great confidence in the ultimate success of the enterprise by providing the necessary funds to carry on the work. Every encouragement, however, was afforded by the excellent output from the San Cayetano mine, which was being worked from the San Cayetano shaft.

While the tunnel was being constructed, and at a distance of some 1,500 meters from the entrance, a shoot of ore was encountered which, being pursued, led on to the famous San Cayetano ore shoot, which resulted in ten years' continuous output of valuable ore, aggregating some three-quarters of a million sterling, which was distributed as dividends among the shareholders of the United Mexican Mining Company, Ltd. This was in the year 1881.

A large sum of money was then expended upon machinery, being paid for out of the huge profits from the

mine, and entirely apart from the amount distributed in dividends. Among the machinery ordered was a magnificent air compressor, which cost £18,000 delivered at the mine. This large piece of machinery is to-day at the Cubo mine but is not being used, the two mines (San Cayetano and Cubo) then belonging to the same company.

The elusive character of the ore shoots in Mexico, as in most mining countries, is proved by the fact that the ore shoot in the San Cayetano mine would have been completely missed had the tunnel happened to be driven at a level twenty feet higher than it was. This arose from no special scientific knowledge possessed by the engineers of that day, but from purely good fortune.

The great value of the San Cayetano mine to-day consists in the enormous extent of undeveloped veins, of which there are six well defined, in addition to numerous others located, distributed over the area owned by the company, which exceeds 700 acres. These veins contain ore of high grade.

It may be mentioned that while some £10,000 might be required to put the San Cayetano mine into a perfect working condition, the mine is perfectly clean, absolutely dry and in the best possible condition for exploitation. All the mine buildings and yard, as I can personally testify, are in admirable condition, some of the most substantial and abiding work having been put in by the former proprietors.

If I am asked for what reason the San Cayetano mine has been worked so little by the present company which owns it, and why it is desirous of selling it, my reply would be two-fold: firstly, the San Cayetano is the

last remaining property belonging to the United Mexican Mining Company, Limited, which has already disposed of all its former holdings and the shareholders of which are desirous of closing down their business and distributing their assets; and secondly, the whole of the profits having been somewhat imprudently and improvidently divided up during the halcyon days, with the result that no working capital was provided, there is to-day insufficient funds in hand to carry on the further development of the property. The fact must be borne in mind that the mine is still being worked profitably, but not nearly as profitably as would be the case were the system of development more expansive and more complete, which the introduction of abundant capital would permit of.

Probably any further extension of this remarkable tunnel would be unnecessary until some further development in the mine itself had been carried out. It is considered that as a commencement there should be a drift run out under the Lourdes shoot from the Año Nuevo crosscut; 100 meters more or less ought to reach the desired point, and encounter the extension downward of the ore shoot which is now being mined by the company near the surface. It would also be desirable to prospect the Emma vein by sinking and drifting upon it at some point not far removed from the northeast end of the San Julian tunnel. The Emma vein is perhaps the largest on the property, and is the one on which the least work has been done. A small shaft was sunk on it and a slight amount of mineral was produced; but these workings are now caved-in and very little is known in regard to this vein beyond the fact that the

hill-side below the outcrop is almost covered with quartz, proceeding from the decomposition of the vein.

The result of some recent sampling has shown that there are large amounts of fillings of a milling grade in the upper workings, known as San Antonio, running very high in gold. Besides this, and of far greater importance, is a large block of solid ground containing pay ore, which has been found above the tunnel and in the Mexiamora ground. This ore extends upward as shown by raise, and it is declared by those who did the last work in the Mexiamora mine that the same character and quality of ore exist in the lower workings of that mine, proving a solid block of ground of fully 300 feet in height and of an unknown length, which is very conveniently located for mining. This Mexiamora mine produced as much as $11,000,000, but the bottom of the mine is still considerably above the tunnel level. This means a large amount of virgin ground between the bottom of the mine and the tunnel level, to say nothing of the possibilities of the ore shoot below the level.

It is now very difficult to obtain properties in Guanajuato, since everything in the vicinity has been very carefully denounced and carried to title with the exception of one strip lying along the northeast side of the property, and following the general line of the Puertecito River. This caused an inquiry into the reason for the ground not having been denounced, and it was found that it had been held for years by different parties, none of whom had ever done any work upon it by reason of its proximity to the river, and at last had allowed it to lapse. Latterly, however, this last remaining claim has been denounced under the name of La Blanca, and

THE SAN CAYETANO MINE.

Property of United Mexican Mining Co., Limited.

Plate 41.]

[See pages 183–190.

now has been added to the San Cayetano holdings. This is not alone a valuable mining claim, but as it extends across the River San Cayetano it affords a fine dam site and water rights for a mill for the property. One of the best-known veins in the vicinity, the Pabellon, runs through this ground from one end to the other, the surface outcrop being just as pronounced as in the Pabellon mine itself.

The following particulars relating to 13 years' production from San Cayetano ore body may prove interesting:

	YEAR.	CARGAS.	RETURNS.	PER CARGA (OF 350 LBS.).
Aug.	1882	1,348	$ 24,059.00	$17.84
	1883	19,768	298,691.96	15.11
	1884	37,352	543,198.30	14.54
	1885	40,592	537,251.13	13.23
	1886	36,751	532,133.96	14.48
	1887	65,704	632,634.29	
	1888	53,972	473,923.00	
	1889		357,119.00	
	1890		257,888.00	
	1891		172,729.50	
	1892	22,551	158,288.00	
	1893	6,957	84,626.00	
9 mos.	1894	3,302	57,764.00	

$4,130,306.14 or, say, £413,030

ORE MINED FROM SAN CAYETANO.

YEAR 1884.

	CARGAS.	VALUE.		CARGAS.	VALUE.
January	3,362	$37,788	July	3,991	$53,926
February	2,817	30,798	August	2,445	37,582
March	2,797	29,661	September ...	2,580	46,101
April	2,650	50,026	October	3,655	46,281
May	3,902	73,172	November ...	2,851	35,451
June	3,134	51,776.	December ...	3,143	50,361
				37,327	$542,923

37,327 Cargas=447,924 Arrobas=5151.1 metric tons.

542,923

5151.1=$105.4 Mex. per ton.

PROFIT AND LOSS STATEMENTS.

SAN CAYETANO MINE.

YEAR 1884.

	PROFIT.	LOSS.
January	$ 12,518	
February	13,170	
March	66,764	
April	16,839	
May	52,808	
June	168,559	
July		$11,698
August	21,746	
September	127,979	
October		6,108
November	17,945	
December	110,119	
	$608,947	$17,806
Loss	17,806	
Profit	$591,141	

THE PABELLON MINE.

The Pabellon mine has been one of the famous producers of rich ore, the period of its greatest production being about the fifties. It is stated that the fear of encountering water was the reason for the neglect of the vein in the ground spoken of as being open to denouncement. This fear may be entirely imaginary, however, as the ground in the vicinity of the vein is very light and solid, and may not permit the percolation of water; at all events, even if all the water running in the little stream were to find its way into the vein, a very small pump would handle it effectively.

LA UNION Y CONSTANCIA.

La Union y Constancia mine is located about six kilometers from the City of Guanajuato, four kilometers of which are over a wagon road and the remainder over a trail, which can easily be made into a wagon road. The property consists of the following claims:—La Union, Fé de Constancia, and their Ampliaciones.

The length of the principal vein, the development of which is contemplated, is 1,600 meters; the depth on the dip of the vein is nearly 420 meters throughout the property, thus forming an explorable area of 672,000 square meters. The vein is the famous "Mother Lode of Guanajuato," running through the district for about 17 kilometers, having a maximum width of 60 meters strike N. 45 degrees W. with an inclination or dip of 45 degrees W. from the horizontal. The rock on the southern extension of the vein, where it is the strongest and on which the La Union y Constancia is located, consists of the hanging wall composed of diorite or green rock, and the footwall a red conglomerate on the surface, which in depth is the same diorite that is encountered in the hanging wall intermixed with carbonaceous slate (ampelita).

The vein filling is composed of seams of quartz, in its different forms, frequently intermixed with calcite and stringers of the same rock, that form the foot and hanging walls, the stratum being generally parallel to the dip of the vein. The principal minerals are argentiferous sulphides and native gold and silver; traces of lead are few, and zinc has never been found. Along the vein, where the body of the same can be measured 60

meters in width, the country rock is intermingled with the vein, which sometimes divides it in three different parts, which are called the vein of the hanging wall, the centre, and the foot-wall veins; but in the region of La Union y Constancia, these divisions are not so well defined. The three parts of the vein above mentioned form one body of from 10 to 14 meters in width. The reunion thus formed gives more probabilities for richness.

A great deal of exploration and exploitation work has been done on this property, with various results. The workings in Cata were deepened, explorations were made in lower levels than those of the Sirena mine (being worked by the Guanajuato Consolidated Mining & Milling Company), and the Cedro mine was deepened to explore the present ore body in the Purisima mine. Additionally there is a tunnel about 800 meters in length, there being 800 meters yet to explore. Starting from the entrance to the tunnel, various crosscuts have been driven to cut the vein, encountering the same 12 meters in width in these crosscuts; 150 meters from the face a vein was encountered 20 meters wide. A short distance north of the last crosscut a rich ore body was encountered, which is technically the continuance of the ore body which originated at the entrance to the mine (Boca Mina) on the top of the hill.

Aside from the Veta Madre passing through the property in question, El Carmen vein and others of less importance pass through this ground; El Carmen vein, which derived its name from the mining property situated about 500 meters west of La Union y Constancia claim, was acquired by, and transferred to, The

Guanajuato Consolidated Mining Company for the sum of $400,000.00. The altitude of the La Union y Constancia tunnel is 2,000 meters above sea level, which altitude corresponds with the same levels in Valenciana, Tepayac, Cata, Mellado, Rayas, Promontorio, Sirena and Purisima del Cedro, where rich ore bodies were encountered, La Union y Constancia being the mine in which the last rich ore body was found. Two workings indicate where profit can be made at once, one of these being the continuation of the tunnel and the other the sinking of a shaft from the tunnel level.

It is estimated that to prosecute the work of the tunnel for the remaining 800 meters on the vein and to reach the line, the cost per meter, including track and extraction, also the necessary timbering, will amount to $24,000.00; to this amount must be added the cost of driving the necessary crosscuts every 40 meters, with an average width of 15 meters each in length to explore the vein on the foot wall and hanging wall. This estimate of $24,000.00 for driving the tunnel, crosscuts, and other work to secure ventilation, could be reduced 30 per cent. by installing an air compressor and air drill using electric power. Aside from the exploitation of the mineral encountered in the tunnel level, one or more upraises can be made in places where there are indications of mineralization, these explorations being valuable and made easy in connection with the tunnel work.

The second work of interest that would have to be performed is the sinking of an inclined shaft from the tunnel level on the vein to a vertical depth of 220 meters, and a total length on the vein of 300 meters on an incline of 45 degrees, which is the inclination of the

vein. This inclined shaft has the advantage that it will not leave the vein, the inclination being regular; which has been proven in all the mines in the district. To investigate the richness of the tunnel in the lower levels, a series of small crosscuts and small shafts should be made; probably, three small crosscuts at a distance of 50 meters, vertical distance, or 70 meters on the vein, and the small shafts in these crosscuts at a convenient distance from the inclined shaft, to secure ventilation at all times.

Considering the location of this property and especially the topographical position of the tunnel, combined with the great advantages accruing from electrical power being available, La Union y Constancia, if in the hands of an enterprising and capable management, should prove a valuable producer. Up till now, litigation has impeded any continuous development; but this having been finally settled, work will shortly be vigorously resumed. This is the last remaining property on the Mother Lode, south of Valenciana, which has not been taken up by British or American capital, but it is practically certain that before these lines are read La Union y Constancia will have been disposed of to a purchasing syndicate of either London or New York.

THE TAJO DE DOLORES.

The Tajo de Dolores mine is another property of which the financial world is destined to hear a good deal in the future. The Tajo vein occurs, and has been both recognized and exploited, at both sides of the Villalpando Gulch (Cañada de Villalpando) through two tunnels

in opposite directions. The West Tunnel opens the La Loca mine, and the East Tunnel the Tajo de Dolores mine. The direction of the tunnels and vein is approximately east and west, with a dip of from 50 to 65 degrees to the south. Consequently, if the vein extends sufficiently towards the east, it must intersect the main Villalpando vein. Towards the west, at 200 meters from the mouth of the La Loca tunnel, the course of the vein comes to an end by splitting into various stringers. The vein crosses near the surface the strata of green sandstone, and in depth is enclosed in the argillaceous schist, which comes in below the green sandstone in the sides of the main Villalpando shaft, near the La Loca mine itself and in the El Capulin mine. This vein, in the La Loca workings, has produced argentiferous ores, with a predominating gangue material of compact quartz, usually white, with enclosures of fragments of wall-rock more or less silicified. The main productive minerals which have been encountered with greater constancy are argentite, more or less seleniferous, in rich stringers, in fine disseminations or impregnations; dark ruby silver, or pyrargyrite in layers or crystalline bunches; and compact polybasite, or disseminated in company with chalcopyrite. Pyrite in small quantity also occurs.

In the Tajo de Dolores mine, the most important development is on the crossings of the Tajo vein with the cross veins of San Francisco and El Baul, with a strike of from 65 to 70 degrees west and a dip of 65 to 80 degrees toward the southeast. In this region, besides the occurrence of argentiferous pay ores, the gold assay of the ores increases, as is the case in the whole Villal-

pando region at the intersection of the main with the cross veins.

The Tajo vein itself shows the same composition as in the La Loca mine, with an abundance of compact quartz as the principal matrix. But the veins of the San Francisco and El Baul, at the junction, show red or oxidized ores with a matrix of more or less porous quartz and ferruginous clay pockets. Some small bunches of ore reached an assay value of 1,000 ounces of silver and 20 ounces of gold per ton (of 2,000 lbs.).

The Tajo de Dolores property covers a portion of what is known as the "Sierra System" of veins, on which are located also the Santa Rosa, San Nicholas, Peregrina and Cubo groups of mines. The Cubo Venture properties are situated to the north and west; the Romana (owned by the Governor of Guanajuato, Señor Don Joaquin Obregón Gonzalez and the Jefé Politico, Cecilio Estrada), to the southeast; to the southwest are several properties owned by various other individuals. These mines have lately been brought into prominence by the revival of work in the old mines of the Guanajuato District, and particularly, through the operations of the new Peregrina Mining and Milling Co. and the Cubo Venture, of which latter, Mr. Thomas H. Legget, the well-known South African mining engineer, is the principal party interested. The Cubo Venture joins the Tajo de Dolores on the northwest, and is worked to a depth of 700 feet below the lowest workings of the Tajo, and on the same vein. On the other side, southeast of the property, the veins continue into the Romano, which has also produced large quanti-

ties of ore, and has been worked down to the same depth as the Tajo.

The Dolores vein occupied a fault plane between the rhyolitic tuff on the hanging wall and the massive rhyolite on the foot wall. The San Joaquin vein is a fissure in the latter formation, which is a characteristic of the foot wall of the Sierra system of veins. The mine is in the Municipality of Villalpando, in the Guanajuato Mining District, at an altitude of about 7,500 feet above sea level, and is connected with the City of Guanajuato by a good wagon road six miles in length.

The property consists of 29.97 pertenencias, equal to about 73 acres. The Tajo has an interesting history. The mine was worked intermittently by the Spaniards up to the time of the Mexican War of Independence, the troubles of which caused its abandonment. Modern systematic work was undertaken by Eusebio Gonzales about 30 years ago, since which time three shafts have been sunk and all the work below the tunnel level carried out. There are no known existing records of the production of the mine prior to the time of Gonzales, but to judge by the extent of the old stopes and the value of the fillings, several million dollars' worth of ore must have been produced from the workings above the tunnel level. During the ownership of the Gonzales family, the mine produced steadily right up to the final shutdown in 1902. All the records are still in the possession of the Gonzales family, who live in Celaya.

The Tajo has been a famous producer of rich ore, however, and the reason for shutting it down was the fact that the water got to be more than could be handled with the small pump with which the mine was provided;

consequently the lower levels were abandoned in 1902, and the water was allowed to rise. The mine, nevertheless, has given employment to numerous small gangs of lessees, who have been working in the upper part and returning a net royalty of $300.00 to $500.00 (£30 to £50) every week since the machinery stopped work.

From the information that one is able to obtain, the mine never seems to have had so good a showing of ore as at the time it was shut down. When the work in the bottom was stopped, the management were underhand-stoping a streak more than 10 inches wide, which averaged $1,300.00, Mexican Cy. (£130), per ton. This rich streak was part of a vein seven feet wide, the rest of which ran $38.00 (£3/16) per ton. The mines of El Tajo and Peregrina were formerly owned by the Gonzales family.

An engineer who examined the Tajo in 1902, at a time when the water was entirely out of it, states that, in the lower level and in the San Joaquin vein, for a distance of over 100 meters, there was a rich sulphide streak, about a foot in width, running the entire distance without a break, and which would average 40 kgms. silver per ton without sorting, and that, alongside of this rich streak, there was an additional width of vein of two or three meters, which would average nearly a kilogram of silver per ton.

The two principal veins running through the property are those of Dolores and San Joaquin. The vein of Dolores extends 1,650 feet through the property with a dip of 60 degrees to the southwest. The San Joaquin vein runs north 70 degrees east, dipping southeast 70 degrees. The veins intersect each other

near the center of the property, and this intersection was the condition which decided the formation of the large and rich bodies of ore for which the mine has been famous. Several smaller veins intersect these principal veins at different points. An enormous stope exists above the San Eusebio level; below this level, the stope narrows up, but just at the water level it expands lengthwise of the vein, and an old plan and some other information show the productive portion of the San Joaquin vein to be much more extensive in the bottom of the mine than at any point above. The San Eusebio shaft, the deepest in the mine, is located on this vein; it is an interior shaft, the collar of which is at the tunnel level. This shaft serves the double purpose of extraction of ore from the workings of the San Joaquin vein and the drainage of the entire mine; the shaft section is two meters by five. The hoisting engines, as well as those for pumping, together with the boilers, were located in the interior of the mine at the collar of the shaft. This arrangement was found to be extremely disadvantageous to the workings of the mine, the smoke escaping through the stopes overhead, rendering that part of the mine absolutely inaccessible, besides which, the consumption of so much fuel in the interior of the mine raised the temperature throughout to a pitch that was most uncomfortable. This shaft is still in very good condition, with the exception of a short distance near the collar, where the shaft passes through the vein and the soft condition of the ground has necessitated some timbering. Below the level of San Nicholas, the shaft enters the footwall, which is very hard rock, the lower part of the shaft, consequently, being quite firm.

Whatever pumping machinery may be needed for the mine will have to be set up in this shaft, as it is the deepest on the property, the water naturally draining to this point. These workings of the San Eusebio vein being the richest part of the mine, it would probably be found advisable to use this shaft also for hoisting, especially in view of the fact that communication exists between the San Eusebio shaft and the workings on the Dolores vein through the level of del Carmen.

At the workings on the Dolores vein another immense stope exists above the tunnel level. This narrows, going downward in very much the same way as the shoot on the San Joaquin vein, and sufficient work has not yet been done to prove whether it opens up again with depth. The deepest workings, however, show good values in the stopes below the Providencia level, and in another stope close to the Dolores shaft.

There are two vertical shafts located on the Dolores vein; the Dolores shaft is sunk directly in the gulch, and passes through the vein into the footwall at the level of the Frente Jesus, the workings below this point being connected with the shaft by crosscuts. The condition of the Dolores shaft is excellent for hoisting, having a section of three meters square, which is sufficient capacity for a double bucket way.

The Purisima shaft is of round section, about two meters in diameter, and could only be used for a single-drum hoist. This shaft is said to be only about 20 meters below the level of the water. The drifts along both veins, contrary to the usual Mexican fashion, are run on level, and some of them provided with cars and track. As far as can be judged by the condition of the work-

ings above the water level, the mine should be in condition for immediate production as soon as the water is pumped out of it. The permanent water level is determined by the Cubo tunnel, at which level the water now stands throughout the Tajo workings; this point is about 200 feet below the tunnel level. The lower 30 feet of the workings are under water.

The principal assets of ore are contained in the veins of San Joaquin and Dolores, consisting of low-grade portions of the veins, the fillings of the old stopes and the several dumps on the properties, which would not pay to work under former conditions of transportation and treatment, but which, under cyanide treatment, adopted at present for the low-grade ores of the Guanajuato District, would yield good profits. The larger bodies of available milling ore, above the level, which have been measured up and computed, are as follows:

In block "A," on the Dolores vein, between the large stope and the water level, there are pieces of solid ground that measure up 20,000 cu. meters, containing 45,000 tons of ore with an average value of $7.00 per ton; total value contained in this block $315,000. Block "B," a triangular block above the tunnel level, on the San Joaquin vein, measures about 7,000 tons with an average of $7.00 per ton; total value, $49,000.00. Block "C," the large stopes on the San Joaquin vein with the pillars and fillings they contain, wherever accessible, show values of about $9.00 per ton; roughly, calculated this stope contains 20,000 tons with a value of $8.00 per ton; total value, $160,000.00. Block "D," about 25,000 tons of dump rock, contained in four different dumps, with a value of $168,000.00.

These give together a total as follows:

BLOCK "A," 45,000 tons.....	$315,000.00	
BLOCK "B," 7,000 tons.....	49,000.00	
BLOCK "C," 20,000 tons.....	160,000.00	
BLOCK "D," 25,000 tons.....	168,000.00	
		$692,000.00

The expense of mining and getting this material to the proposed mill ought to be easily covered as follows:

52,000 tons solid rock at 90c. per ton..	$46,800.00	
20,000 tons fillings at 50c. per ton.....	10,000.00	
25,000 tons dump rock at 25c. per ton..	6,250.00	
97,000 tons milling at $1.60 per ton....	155.200.00	
		$218,250.00
Net return, U. S. Cy.....		473,750.00

I append a table showing the officially certified annual production of the Tajo de Dolores Mine for years 1882-1884 and 1887-1903, inclusive:

1882	1,506.118	0.763	4.0	$55,966.72	$7,831.20	$63,797.92
1883	2,406.848	0.905	4.0	87,127.88	12,505.10	99,632.98
1884	2,876.419	1.196	4.0	187,607.88	14,956.50	152,564.38
1887	1,447.760	0.860	4.0	49,802.92	7,528.30	57,331.22
1888	1,628.605	0.997	3.0	64,948.76	6,350.50	71,299.26
1889	1,136.966	0.767	3.0	32,884.88	4,433.00	37,317.88
1890	597.965	1.125	4.0	26,908.40	3,108.30	30,016.70
1891	867.674	0.848	4.0	29,431.48	4,511.00	33,242.48
1892	1,208.131	0.836	3.0	40,399.88	4,711.00	45,111.08
1893	1,349.813	1.599	5.0	86,334.00	8,773.70	95,107.70
1894	1,305.744	1.869	6.0	97,617.40	10,184.20	107,801.60
1895	1,723.550	1.277	4.5	84,038.92	10,081.50	94,120.42
1896	3,815.374	1.006	3.5	153,530.64	17,358.90	170,889.54
1897	3,427.144	0.971	3.0	137,110.24	11,365.30	148,475.54
1898	6,126.925	1.111	4.0	272,280.52	31,859.10	304,139.62
1899	4,397.558	1.029	3.5	181,003.52	20,008.30	201,011.88
1900	3,549,708	1.173	4.0	166,552.20	18,457.40	185,009.60
1901	3,352.087	0.284	3.0	131,938.12	13,072.80	145,010.92
1902	3,311.551	1.003	4.0	132,859.40	17,219.80	150,079.20
1903	1,226,887	1.446	3.5	70,963.12	5,582.20	76,545.32
	47,269.825			2,039,306.94	229,898.30	2,269,205.24

GUANAJUATO: THE YARD OF THE REFUGIO MINE, LA LUZ DISTRICT.

Property of the Guanajuato Development Co.

It is necessary to add that the values of the preceding productions are based on silver at $40 per kilogram and gold at $1.30 per gram (Mexican Cy.).

THE REFUGIO.

The Refugio group of mines, situated on the famous La Luz vein comprises six different properties, at one time held by as many different proprietors. To-day they are comprised under one management, namely, the La Luz Mines Co. The total area of ground covered is a very considerable one and a very large amount of development work has been carried out. These mines have been worked for over a hundred years, the first Guanajuato mineral discoveries having been made on the La Luz vein. The Santa Clara, the San Vicente and the Refugio are new consolidated, and known as the Refugio; the three shafts have been sunk to a depth of 800, 750 and 1,000 feet respectively. These shafts are all connected with levels. The average value of the ores is $12 (say £2/8) per ton, and the mine has a probable value of several hundred thousand dollars from ores in sight and on the dumps, as well as fillings. The character of the rock is quartz with sulphides of silver and gold, and is very easily treated, being typical cyanide ore. The same class of mill fully decribed by me in connection with the Peregrina mine would be admirably adapted for treating the Refugio ores. In fact this portion of the camp resembles very closely the ground occupied by the Peregrina, carrying a large proportion of free milling gold. It may be added that these three mines have in their day produced something like $50,-

000,000, at a time when silver ranked with gold in value. Under the new methods of treatment available, and with the spirited management now being displayed in the camp generally, it is certain that this group will again prove of great producing value, and take their position in the front rank of successful companies in the Guanajuato district. This much may be said, that the vein has been proven to exist and in good ore at a depth of 800 feet lower than the present workings, namely, 1,000 feet in Refugio.

THE BOLAÑITOS.

The Bolañitos group of mines, the present property of Señor Jesus Andrade, is likely at no distant date to become the property of an English corporation, negotiations at the moment proceeding for their acquisition, but not being actually concluded at the time of this volume going to press.

Like most, if not all, Guanajuato mines in the La Luz district, these mines are celebrated and have had a history of their own. This history brought down to present times is somewhat litigious in character, the outcome it would seem of too much money having been made and feelings of envy and jealousy having been excited. At least this is according to one of the versions in circulation, but naturally there are others. There seems to be no doubt that the returns secured over a period of five years amounted to $7,000,000 Mex. (say £700,000).

The Bolañitos group comprises the following mines:

La Soledad del Abasta Viejo,
La Parfia,
La Restauradora,
La Esperanza,
La Caridad,
La Soledad de las Carreras,
El Cuevo, La Cruz, El Peru,
La Voluntad de Dios,
Los Angeles,
Santa Rita (Bolañitos),
Santa Gertrudis,
San Evodio,
Santa Elena,
La Perla,
Los Reyes,
Thesalia,
Golconda, El Carmen,
Ophir.

These properties have a total superficial area of about 323.27 pertenencias, say about 800 acres, a perfect network of veins permeating them. There is no question that there exists great widths of low-grade gold ore above the water level, the former working having been such as to leave a good deal of ore in the mine. Above the water level there are also pillars and fillings. The mine is at present 500 feet under water; it has been worked only to a depth of 700 feet, but the bottom has been left perfectly good. Another important portion of the property is found in the Restauradora Tunnel, where, besides a net work of gold-bearing veins, there are three dipping east and one dipping west, which have given values of from 30 grams of gold up to 7 kilos of gold per ton, and which would form the basis of an extremely good milling proposition in themselves. There are five vertical shafts, five tunnels and several inclines upon which are installed five English steam hoists of from 10 to 25 horse-power, two crushers and dynamos for 100 lights, extensive houses and offices and tools of many kinds.

THE CUBO MINES.

The Cubo group of mines is of considerable importance and extent, and has a substantial record of production to its credit. It is one of the oldest properties worked at Guanajuato, and the books of the various mines composing the group form some interesting reading to the antiquarian and geologist, to say nothing of the man who would know something of what mining cost and yielded in the olden days. The ground contains some extremely rich veins, the principal mine (the Cubo Venture) having been worked down to a depth of 2,000 feet. This property is on the Sierra vein system, and has a modern mill of some 15 stamps and a cyanide plant. It is understood that the Cubo property will shortly change hands, as it is under offer to some New York capitalists at present.

Several important experiments have been tried upon the Cubo mine, such as the first cyaniding by the well-known MacArthur-Forest process, and although this did not turn out to be a success at first, it soon afterwards did so, and was finally adopted generally on the Guanajuato mines. The Cubo, like so many other properties, formerly belonged to the United Mexican Mining Company, Limited, and has all the makings of a sound and profitable enterprise under competent management.

Chapter XIV.

The Guanajuato Power and Electric Company.—What the Mines Owe to Electrical Energy.—Capitalists' Support.—The Area of Distribution.—Pipe-lines 3,300 Feet Long.—Generating Station.—The Turbine Wheel versus Impulse Wheel.—Power House.—Generating Station.—Transmission Line.—Irapuato Substation.—Guanajuato Substation.—Electrical Equipment.—A Growing Demand for Power.

IN considering the conditions that have produced a new era in mining methods in Guanajuato, it is essential to give due credit to the introduction of electric power in abundant quantities; in fact, the introduction of electrical power may be considered as having caused, to a greater extent than any other factor, the present era of prosperity.

Some four years ago, when the question of bringing power into Guanajuato was first considered, there were but sixty stamps operating in the district; to-day, mills are in operation, or in process of construction, with a total of 580 stamps, and many more large mills are in contemplation. The promoters of the Guanajuato Power and Electric Co. had evidently great faith in the future of Guanajuato; but before it was decided to build the power plant, a careful study was made of the conditions prevailing in the camp, and it was believed that even the old dumps of most of the mines could be milled and made to pay a fair return on the investment. However, it was impossible to tell to what extent ore would be found below the old workings, but it seemed

reasonable to suppose that a camp which had given such great returns for three centuries under the old methods of mining and milling would, when new methods were adopted, again become a great producer. The first requisite in the introduction of modern mining methods was, however, cheap and reliable power; and after the conditions were thoroughly understood, capitalists were induced to subscribe the necessary money to build a power plant for Guanajuato, in the belief that other capitalists would take over the principal mines and make them great producers.

It was decided to bring power to Guanajuato before a water power was found, and it was fortunate that the man who first conceived the idea of bringing that power to Guanajuato was one conversant with the best electrical transmission practice, otherwise its consummation might have been delayed for many years, for no suitable water power was found within 100 miles of Guanajuato, a distance which to most engineers would have seemed wholly impracticable under the conditions then existing.

The Guanajuato Power & Electric Co. has a water power upon the Duero River, near the City of Zamora, and transmits power 101 miles on a steel tower transmission line into the City of Guanajuato. It also has a substation at the town of Irapuato, controlling a secondary distribution system which is operated at 15,000 volts. In Guanajuato the distributing system is at the potential of 15,000 volts, and power is carried at this pressure as far as the town of Leon, lying some 30 miles northwest of Guanajuato. Besides this, there is a distributing system of 15,000 volts starting west from the generating station, feeding a district along the shores of Lake

Chapala as far as the town of Ocotlan, 40 miles distant from the generating station. The company is distributing power, at the present time, over 103 miles of steel-tower transmission lines, at a potential of 60,000 volts, and over 100 miles of pole-lines at the potential of 15,000 volts. It also has in contemplation the erection of additional lines to reach other important cities and mining districts. With the exception of some unimportant branch lines, in connection with which it was questionable whether the use of power would be continuous and would therefore warrant the best construction, all the distributing lines of the Power Company were made in the most thorough and substantial manner.

The company operates under a concession granted by the Federal Government of Mexico, giving it the right to use 8 cubic meters, or 283 cubic feet, of water per second from the Duero River, near the City of Zamora, as already mentioned. By the construction of four miles of canal, a fall of 100 meters, or approximately 330 feet, is secured. The canal is for the most part dug out of volcanic rock, and the head-gate, penstock, aqueducts, etc., are constructed of heavy masonry. A novel feature in the hydraulic work is a terminal reservoir, which was constructed at a considerable cost to get a sufficient amount of storage for regulating the fluctuations in the power load during different periods of the day.

Water is taken from the penstock to the power-house by means of two pipe-lines 3,300 feet long, varying in diameter from 57 to 69 inches. A pipe-line was constructed when the plant was first put in, and was made throughout of steel varying from 5/16 to $\frac{5}{8}$ of an inch

in thickness, depending upon the amount of the water pressure. At the present time the second pipe-line is being erected, but in this wooden stave-pipe will be used for the first 1,500 feet, or up to a head of approximately 150 feet; from that point down to the power-house steel-pipe will be used, in conformity with the first pipe-line, but of somewhat different design. This new steel-pipe is lap-welded, so there will be rivets only at the junction of two pipes, and the ends are made "male" and "female" so that the lower end of one pipe fits accurately inside of the upper end of the one following. Large gate-valves have been put in each pipe-line just before they enter the power-house, and there is also a crossover between the two pipe-lines containing a gate-valve, so that it is possible to run all the units from either of the two pipe-lines.

The generating station was designed for 4 generating units of 1,500 Kw., direct connected to Pelton water-wheels at 200 R. P. M. and the installation first completed consisted of two of these units. At the present time, however, a 3,000 Kw. unit is being installed, driven from a turbine water-wheel built in accordance with the Escher-Weiss patents. The first generating units installed were designed with but two bearings, two Pelton water-wheels being overhung from the ends of the generating shafts, instead of being built with separate bearings and frames and connected by means of couplings. The Pelton water-wheels are equipped with deflecting hoods and needle nozzles. The deflecting hoods are operated by Lombard governors, and the needle nozzles by hand. The speed regulation is therefore obtained by varying the positions of the deflecting hoods, and

THE EL CUBO MINE, NEAR GUANAJUATO.

Plate 44.]

[See page 205.

hand regulation from the needle nozzles is only resorted to in order to increase or decrease the size of the stream.

At the time that the generating plant was designed, it was generally conceded that turbine water-wheels would not give satisfaction when operated under a pressure of 140 pounds per square inch; but since that time there has been great advancement in the design of turbine water-wheels, and as there are distinct advantages in the turbine wheel over the impulse wheel, it was decided to change the original plan and to put in a turbine generating equipment of the capacity of the two present generating units.

The power-house is 200 feet long and 32 feet wide, built of solid masonry and with a steel roof. At one end are located the high tension transformers, and through the main body of the house are the various generating units, with their water-wheel governors and various valves. Two cranes of 10 tons each run the entire length of the building, so as to facilitate the making of repairs. The switchboard is directly in front of the generating room, in a small extension of the building, and the operator at the switchboard is, therefore, situated where he can observe the operation of all the machinery. A rather curious feature in connection with the power-house is the level of the floor, which is considerably lower than the level of the outside ground, a tailrace 500 feet long and approximately 20 feet deep being excavated to carry away the water discharged. It is, therefore, exceedingly difficult to publish any picture of the power-house which would give readers any idea of its true proportions, as I should have liked to have done.

The generating units are three-phase, 7,200 alterna-

tions of 2,300 volts. The machines running from the Pelton water-wheels operate at 200 revolutions, and those to be driven from the turbine at 514 revolutions. A switchboard of blue Vermont marble is used for controlling the generating units and the feeders to the step-up transformers, and no switching is done upon the 60,000 volt lines when carrying power. The generating station has now been running some two and one-half years and no difficulty whatever has developed in the operation of the machinery and transformers.

The transmission line between the generating station and Guanajuato is constructed on steel towers made by the Aeromotor Co. of Chicago, placed 440 feet apart, supporting three copper cables of a carrying capacity equal to No. 1 Brown & Sharp solid conductor. The insulators were built by the Locke Manufacturing Co., and were considered the best on the market at the time that the transmission line was designed. This line was the first which was ever built with steel towers and long spans, and was undoubtedly a great advancement in transmission line construction. This same construction will be used for other high potential transmission lines now in contemplation by the Guanajuato Power and Electric Company. The transmission line has very few horizontal angles, and there are stretches as long as 25 miles with practically no horizontal or vertical angles.

The Irapuato substation is equipped with 600 kilowatts transformer capacity, and it is expected that this will be increased to 2,000 kilowatts within a short time, in order to supply power for the City of Celaya and other districts which will be fed from a 50 mile 33,000 volt distributing line, to be erected upon iron poles. Around

the town of Irapuato, power is supplied for agriculture and manufacturing purposes. A good portion of the power is used for pumping water from wells for the irrigation of strawberries, the growing of which is an industry for which Irapuato is justly famous.

In Guanajuato the company owns some extremely attractive grounds situated at the upper end of the city, where the substation and residence buildings are also located. The substation contains besides the electrical equipment, a shop and testing room, as well as the main Mexican offices of the company.

The electrical equipment consists of eight 970 kilowatt transformers, reducing the pressure from 60,000 to 15,000 volts, together with the necessary switchboards and switching devices, and everything is built in the most thorough and substantial manner. From the substation, eight distributing circuits are carried out upon five different pole-lines for supplying power to the various sections of the mining camp and the town of Leon. In all, there are some 60 miles of 15,000 volt-distributing circuits fed from the Guanajuato substation, and other lines of importance are projected for supplying additional new districts. Transformer houses are located at the various mines for reducing the voltage from 15,000 to 460, the potential generally used by the mining companies. The distributing lines, as first constructed, were erected upon wooden poles; but these are now to be replaced by iron poles, where the load has become important, and in time the whole system will be changed from wooden to iron construction.

The Guanajuato Power and Electric Co.'s power-load has developed from below 1,000 horse-power to more

than 4,000 horse-power, and the contracts now in sight will still further increase the demand for power. In view of the probability that the water-power already developed will prove inadequate for the future needs of Guanajuato and other places, the company is taking steps to develop other water powers in the near future. It is also making various improvements in its distributing circuits and transmission lines so as to meet all future needs of its customers and guarantee to them the best of service.

The effect upon the Guanajuato mining camp of the building of such an important power plant cannot be overestimated, for the company has reduced by at least one-half the cost of power, at the same time furnishing power to its customers, and moreover power that can be readily applied in many cases where the direct application for steam power would be impossible. The credit for such an important enterprise is due principally to Messrs. Hine and Curtis, who originally conceived and promoted the enterprise, and scarcely any less to Mr. G. W. McElhiney, of Guanajuato, who co-operated with them and conducted the Mexican end of the promotion. Credit should also be given to the strong body of capitalists who pluckily came forward with a million dollars (£200,000) for the purposes of the construction of the power plant.

The preliminary engineering and reports upon the water power and power field were made by Messrs. Robert McF. Doble, of San Francisco; Mr. H. H. Filley, of Kansas City, and Mr. Chas. T. Main, of Boston. Mr. Doble acted as consulting engineer, and Mr. Filley as chief engineer during construction. Mr. Filley took

THE GUANAJUATO POWER AND ELECTRIC CO.

direct charge of the construction of the hydraulic work and generating station, and Mr. Norman Rowe had charge of the construction in the Guanajuato Camp, and is now General Superintendent in charge of operation and the commercial business in Mexico.

It is stated that the path of the Guanajuato Power and Electric Company was not always as smooth and as prosperous as is the case to-day. It was extremely difficult to convince some of the companies working that electric power was possible, or, being possible, that it could be applied economically and reliably to the mines' machinery. One far-seeing individual, a native, went so far as to ostentatiously order and erect a new steam-hoist at the very time that the electric companies' cables were being brought into Guanajuato. That foolish and misguided man has lived to repent his temerity, and has now learned that "ignorance never settles a question." To-day that steam-hoist is for sale as old-iron!

But, although eventually nearly all the mining companies and private owners signed contracts for the new motive power, only one out of the whole lot was actually ready to connect up when it arrived. The electric current was waiting for nearly a twelvemonth to turn the machinery, some of which was still on the road.

But things are very different to-day, and there is no better supplied nor any better-lighted town than that of Guanajuato, which scintillates at dark, and, from a height, looks like a beautiful golden glowworm twinkling and sparkling in the soft darkness of the night. Disappointing as they may have found their reform efforts at first, the plucky pioneers and sponsors of the

Guanajuato Power and Electric Company can point with pride and satisfaction to the latter-day prosperity with which they have met. But cause for congratulation rests with the mining companies especially, since their former failures have been turned to successes and their disappointments to brilliant realizations.

Chapter XV.

British Capital in Guanajuato Mines and Mexico Generally.—Two Great Concerns, one Dead and the other Dying.—Some Defective Management of By-gone Times.—Ward's Criticisms of Companies in his Days.—The Anglo-Mexican Company and The United Mexican Company.—Some Historic Mines and What has Become of Them.—Extravagant Management but Huge Profits.—The Question of Titles.—Mines Selection Company of Mexico.

FROM a Britisher's point of view it is somewhat mortifying to read of the former importance which British enterprises possessed in Mexico, especially with regard to mining, compared with their position to-day. Whereas probably the sum of £80,000,000 would represent the whole of the capital invested in this country by Great Britain at this time, as far back as 1827, and even earlier, mining alone undertaken by British investors exceeded in value £5,000,000. Considering the almost overwhelming difficulties which enterprises of this character had to encounter in those days, when there were no railways or decent wagon roads by which machinery could be transported to the mines, and when every pound of such material had to be carried on mule-back, it is surprising to find that the industry advanced as far as it did.

The two greatest British concerns had their offices in Guanajuato,—the Anglo-Mexican Company and the United Mexican Company.

No doubt in those days money was lost almost as rapidly as it was invested, owing to the ignorance which

prevailed in regard to the mining conditions of the country, and the incompetent persons who were sent out to take charge of the mines. History repeats itself in no particular more remarkably than that of mining, and what happened in Mexico in those early days has been experienced in South Africa, New Zealand and Western Australia since. Not only were men who knew absolutely nothing about mining sent out to take charge (being probably relatives of some of the Directors who had to be found jobs somewhere and somehow), but gross exaggeration was indulged in as to the real value of the mines themselves. A very different condition of things exists to-day both in regard to management, direct representation and accurate reports upon the values of properties, and all immensely for the better.

Although I say it with regret, and am in no way lacking in respect for the individual in question, there can be no doubt at all that Baron von Humboldt was (perhaps unwittingly) responsible for most of the false impressions which were created in Europe as to the Mexican mines and their working. No allowances were made for the serious drawbacks to which I refer, including the difficulty of transportation, the lack of efficient native labor and the general disturbance of the country. So ignorant were those who invested their money in mining in Mexico in the early days that they actually believed that everything existed to hand except water, and that this was to be obtained by the latest kind of British mining machinery! But Von Humboldt's *réclame* had its effect, a stream of immigrants from all parts of Europe arriving, especially from England,—Cornwall being drained of half its population,—men

who were miners and men who were not and never would be "miners"—proceeding to the new El Dorado, only, of course, to be disappointed and disillusionized when they got there.

Ward, in his work on Mexico, states that in the year 1825, the Anglo-Mexican Company alone "expended nearly £30,000 in salaries to men, most of whom were shortly afterwards dismissed," and fully £100,000 in machinery, including duties and carriage from the coast, "not one-twentieth part of which was ever made use of." This same authority apparently encountered in his day a very similar class of men to those whom I and others have met with at several mining centers abroad, and notably in our own colonies, for he says:—"English of the lower orders appear to undergo a change when they leave their own country, which renders them the most inefficient of human beings,—indolence, obstinacy and insolence take but too soon the place of those qualities by which our working classes are distinguished at home, and as their prejudices are not less strong than those which they have encountered on the part of the natives, the result in all cases, where mutual assistance is required, cannot be favorable."

Proceeding, he declares that " the rage for taking up mining contracts was such in 1825 that many adventurers who presented themselves in London for that purpose disposed of mines, the value of which was, to say the least, very questionable, to companies who bought them without making any inquiries"; large sums of money were paid down "for mere pits, which, upon investigation, it was found impossible to work."

With such an example before us to-day, it should be

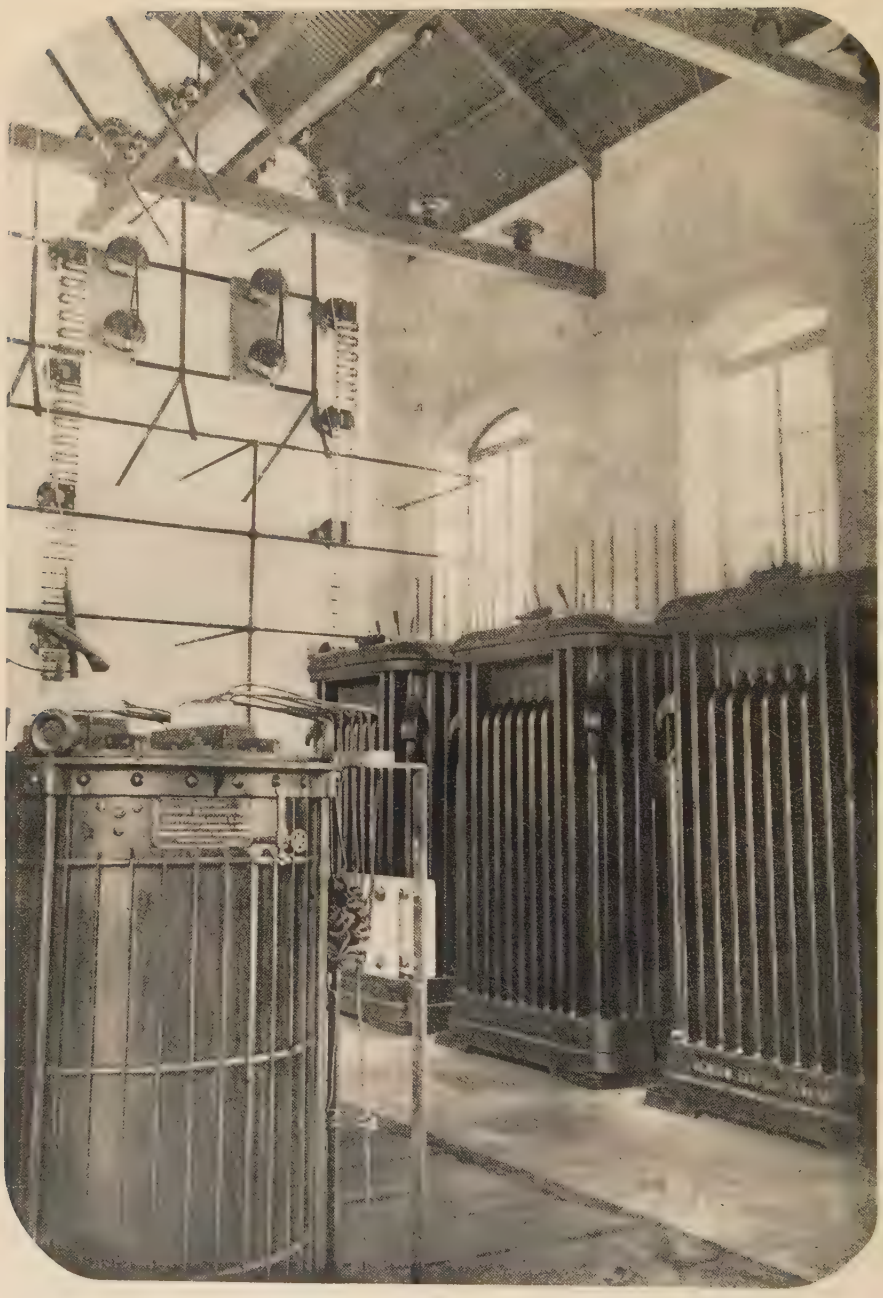
a comparatively easy matter to avoid making any similar mistakes in future, nor, indeed, is it at all probable that future investors in Mexican mines will go far wrong in their selection provided that they will avail themselves of the abundant opportunities that exist for making proper inquiries from responsible people on the spot.

Among the oldest mining companies formerly working in Mexico and having large holdings in Guanajuato, were the said Anglo-Mexican Company and United Mexican Company. Both were heavily capitalized, the former having £1,000,000 and the latter £1,200,000. The Anglo-Mexican Company had holdings in Guanajuato, Mexico, Queretaro, San Luis Potosi and other States; while the United Mexican Company possessed huge interests in the States of Guanajuato, Guadalajara, Zacatecas, Chihuahua, Oaxaca and Mexico.

In Guanajuato the Anglo-Mexican Company owned or leased the following mines: The Valenciana, The Mellado, The Tepayac, The Sirena, The Villalpando, and several mines on the Veta Madre and smaller veins.

Of all these properties none remain to-day in the possession of the company, which, however, is still living—but is almost defunct; and in fact it will probably go out of business entirely as soon as one remaining mine, the San Cayetano, of which it still holds possession, is disposed of.

The United Mexican Company leased the Rayas mine from the Marquis de Rayas, whose ancestor had been ennobled on account of the generous donations which he made from his mine to the King of Spain and to the Roman Catholic Church. The Rayas is credited with having been the first silver mine discovered in the Guan-



THE GUANAJUATO POWER AND ELECTRIC CO.

Interior of sub-station at Guanajuato.

Plate 46.]

[See page 211.

ajuato district, and was worked for many years by the Rayas family with wonderful results. The same company, at this time, possessed the Jesus Maria mine at La Luz (now the property of the Guanajuato Amalgamated Gold Mines Co.), El Cubo, La Cata and others. As has been shown, one by one these properties were parted with, the San Cayetano being the only remaining one in the hands of the company. The original shareholders have long since passed away, and the present ones, it is understood, are anxious to wind up the affairs of the company permanently and let it retire from business. The San Cayetano has been the property of the company since the year 1868, and has been celebrated on account of its remarkable tunnel, 3,036 meters long, which it paid for in two years' profits from the mine. The Valenciana is now the property of the Reduction and Mines Co. of Guanajuato, as are the Mellado and the Tepayac.

The Sirena is the property of the Guanajuato Consolidated Mining and Milling Company, the Villalpando (now incorporated in the Cubo group) is the property of some New York capitalists, and may shortly be sold to an English syndicate or an American company, and thus the story continues.

The mines controlled by the United Mexican Company in Guanajuato comprised the Rayas, the Secho, the Cata, the Calera, the San Roquito, the San Rafael, La America and the Guadalupe. Here, again, most of these properties have passed into other hands, and the parent company itself has faded out of existence. The various holdings which it had in other States of Mexico, some of which have become famous, do not concern the

pages of this publication, which proposes to deal exclusively with the mines of Guanajuato and their particular history.

It is fortunate that there are still in existence to-day copies of the original prospectuses issued in 1824 and 1825 of these two British companies doing business in Mexican mining. A most remarkable feature of these musty documents is that many of the names therein mentioned are still known, and known honorably, in the City of London and Mexico to-day, although the original owners have long since passed away from this world of tribulation and disappointments.

The Anglo-Mexican Company, which was the pioneer enterprise for working the Mexican mines upon a systematic and efficient scale, points out in its prospectus that it was "an association for assisting in working the mines of Mexico and other parts of Spanish America." By the prospectus it appears that it "was formed for the purpose of supplying capital for putting in activity some of the principal and most productive mines in Mexico." That "the working of these mines had been suspended during the Revolution on account of the disturbed state of the country. That the principal part of them were, in consequence, nearly filled with water, and that the proprietors, through the deprivation of their income, were without the means of restoring the mines to their productive state." That "contracts had been entered into with the proprietors of mines for working them on terms of mutual advantage, consisting, in some cases, of a right to a share of the product of the mine for a term of years; and, in other instances, of the cession of part of the proprietorship."

The prospectus continues with much precision and persuasion to point out that "it was expected, from the negotiations then in progress, that other contracts would be hereafter offered to the association in Mexico and other parts of Spanish America, but that the association was to confine itself only to those mines which were opened, the value of which was ascertained by authentic documents, and the working of which had been suspended only by temporary difficulties. The association was not, therefore, to embark in the speculation of opening new mines." It appeared that six mines were already engaged by the association. "The necessary machinery was immediately to be prepared and forwarded to Mexico in performance of their contracts." The capital of this company was £1,000,000, divided into 10,000 shares of £100 each. The following individuals were the directors and auditors:—

DIRECTORS.

Mr. Matthias Attwood, M. P.,
Mr. J. H. Anderdon,
Mr. David Bevan,
Mr. David Barclay,
Mr. Charles Herring,
Mr. George Lyall,
Mr. Stewart Marjoribanks,
Mr. J. D. Powles,
Mr. R. M. Raikes,
Mr. Benjamin Shaw,
Mr. W. Thompson, M. P. and Alderman,
Mr. William Ward.

AUDITORS.

Mr. William Fry,
Mr. Thomas Richardson.

The belief avowed in the prospectus of the Anglo-Mexican Association or "Company," as it was variously called at different periods of its career, was, "that by the introduction of English capital, skill, experience, and machinery, the expenses of working these mines might be greatly reduced, and their produce much aug-

mented"; and it was stated that the proprietors of one of the mines, viz., the Valenciana, calculated that they would be able to provide for the repayment of the advances to be made for working that mine within two years from the commencement of that working, and also to make a division of profits. This association was formed in the month of January, 1824. On February 26, 1825, a meeting of the proprietors of the Anglo-Mexican Association was held, and a report of its proceedings was then submitted. By this report it appeared that the commissioners on behalf of the association reached Mexico in the middle of the month of August, 1824, and, on November 15 following, transmitted to the directors in England information that the following mines were either being worked or in a state of preparation for working:—

GUANAJUATO VEIN.

Mines: Valenciana, Sirena, Santa Rosa, Guadalupe.

CATORCE VEIN.

Mines: Concepcion, Guadalupe.

Of these mines, the two principal were then the Valenciana and Concepcion. The first was, of course, the most celebrated in Mexico. It had even at that time been worked sixty years. Its average annual net product, from 1792 to 1802, was not less than £150,000 per annum, and although during those years, by its injudicious management, the expenses of its working were doubled, the supply of ore was, nevertheless, so considerable that the net profit remained the same.

In relation to the United Mexican Mining Association, which appeared very shortly after the Anglo-Mexi-

can, it would seem from a prospectus of this company, "that, owing to the want of capital, it has been customary for proprietors of mines in Mexico to form engagements with capitalists, by virtue of which the capitalist undertakes to work the mine upon terms of expected advantage to both parties." That the association "was formed for the same purpose: and it appears that the objects of this association were to be obtained by the combination of European skill and capital with Mexican interests. For this purpose Don Lucas Alaman, late representative in the Spanish Cortes for Guanajuato, had been associated with the company, and was to be appointed the president of the Mexican board of management; but it had not been deemed expedient to enter into actual contracts for working mines until an association had been formed and the extent of its capital ascertained. In case the plan for forming an association was successful, and mines were obtained, a dividend was promised as soon as a profit of 5 per cent. was realized."

The capital of the association was to be £240,000 and divided into six thousand shares of £40 each. This was afterwards increased to the sum of £1,200,000. The following individuals appeared on the prospectus as the intended directors and auditors:

LONDON DIRECTORS.

Mr. John Biddulph,	Mr. Thomas Masterman,
Mr. Samuel Bosanquet,	Mr. Frederick J. Pigou,
Mr. John Easthope,	Mr. Jacob Ricardo,
Mr. Charles David Gordon,	Mr. Richard Sanderson,
Mr. James Heygate, jun.,	Mr. Rowland Stephenson,
Mr. John Hullett,	Mr. Charles Widder.

AUDITORS.

Mr. Thomas Borradaile,	Mr. Joseph Harris.

MEXICAN BOARD OF MANAGEMENT.

President,.....Don Lucas Alaman;

and two Managers, to be appointed by the Court of Directors.

An association was eventually formed. On March 1, 1825, a meeting of the proprietors of this company was called, when they were informed that the mines of Rayas, Cata, La Bomba de Copula, Santa Ana, San Juan, and San Miguel, situate in the Guanajuato district, had been engaged for the purposes of the company, but that a detailed report of the proceedings and progress of the association was daily expected from the president of the Mexican board of management, and therefore it was deemed expedient not to enter into a minute account at the present meeting. The above mentioned increase of the capital of the association was agreed upon, and, finally, 18,000 new shares, of £40 each, were issued, followed by another of £240,000 later on; each holder of a former share having the liberty to take three of the new shares of the company.

It was in about the year 1824 that the Anglo-Mexican Company, Ltd., was formed in London, and A. M. Williamson was the managing director. When this concern took over the properties of the Valenciana, the Mellado, the Tepayac, the Sirena, and the Villalpando, they were in a state of almost complete ruin. One year afterwards the broken machinery had been entirely replaced, the Villalpando and Sirena had been nearly drained of their water, and the Valenciana was producing about 10,000 tons of rich ore weekly. The manager of that day was a brilliant one evidently, for, in a few months' time from taking over possession, he had built no fewer than nine haciendas de beneficio (amalgamation works) and had erected and equipped a number of crushing mills. As many as 3,100 mules were employed at one time on the drainage works, while another 400

were doing duty in carrying ores from the mine. The weekly wage-bill of the Valenciana alone, which was then and for many years afterwards the principal undertaking of the company, amounted to the sum of £1,200; while, up to the date of September, 1826, about 18 months after the company took over this mine among the others mentioned, the expenses totalled up to £134,-452. It is clear that in those far-off days no money was spared in the way of development, and in some instances —especially that of the Valenciana—the outlay was abundantly rewarded.

Before the Anglo-Mexican Company came into possession, and just when the Valenciana had reached the profitable stage, the Mexican Revolution broke out with great fury, putting a temporary stop to all work. At that exciting period the mine was actually putting out ore to the value of £289,213 per annum; so that the Anglo-Mexican Company knew what they were doing when they purchased the mine in 1825 for a comparatively modest amount of ready cash.

The weekly expenditure of the United Mexican Company, Ltd., was another big item in mine management at Guanajuato in the early days of British industry there. The directors of this company were Mr. Glennie, Mr. Lucas Alaman and Mr. Agassiz. Speaking of his first visit to Guanajuato, however, Mr. Ward says that he was particularly struck with the fact that, in spite of all that the British companies had done and all the money which had been expended there—amounting to more than had been expended upon any other single spot in the Republic—"this was nothing in comparison with what must formerly have been done," that is to say

anterior to the Revolution. The United Mexican Company spent £100,000 on the Rayas mine in a few months' time; and almost similar sums were expended upon the La Veta Negra, at Sombrerete, and upon other mines owned by the same company in Zacatecas.

So extravagant was the management of the United Mexican Company in the early days of its career that the shareholders at home vigorously objected, and one result of this was that nearly all the British and other European workmen and officials were dismissed, and only native Mexicans engaged. The opposition from London was not unreasonable when one comes to remember that the sum of £30,000 had been paid in about one year's time to men most of whom had to be dismissed for incompetency or insubordination, while £100,000 had been expended upon machinery not one twentieth part of which, we are told, was ever used. It would appear then that the lamentable experiences at Panama were not so unique as historians have represented, although they were no doubt more extensive. It is only another proof of Solomon's wise words—"There is nothing new under the sun."

There is probably no subject which concerns shareholders interested in mining businesses located in foreign countries, more vitally than that of titles. It is to be feared, however, that this matter is not as thoroughly considered by investors as it should be, while purchasers of mining properties, whose sole idea is, perhaps, to redispose of their acquisitions at high profits—and as soon as possible—frequently display lamentable negligence in assuring themselves as to the legality and reliability of such titles. In Mexico, where mining laws

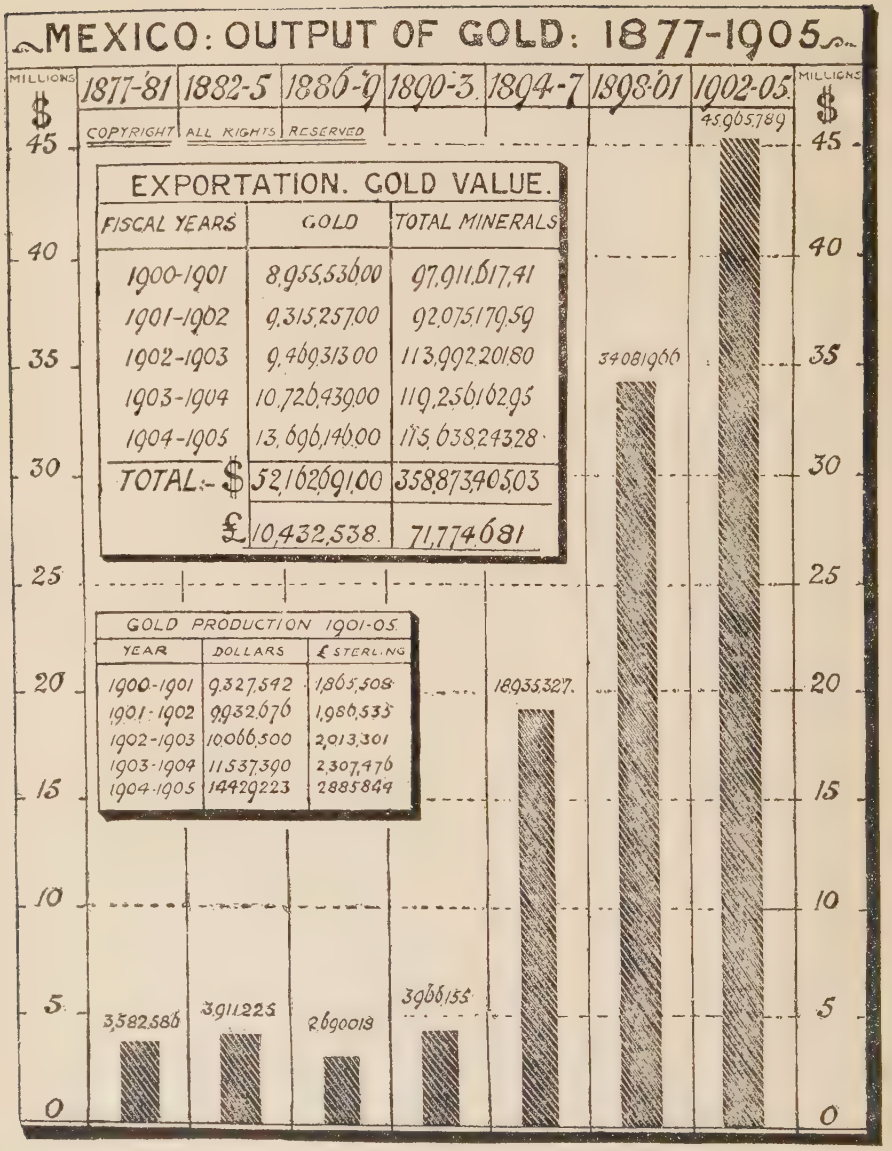

MEXICO: OUTPUT OF GOLD: 1877-1905
MILLIONS $
1877-81
1882-5
1886-9
1890-3
1894-7
1898-01
1902-05
COPYRIGHT ALL RIGHTS RESERVED
45
40
35
30
25
20
15
10
5
0
EXPORTATION. GOLD VALUE.
FISCAL YEARS | GOLD | TOTAL MINERALS
1900-1901 | 8,955,530.00 | 97,911,617.41
1901-1902 | 9,315,257.00 | 92,075,179.59
1902-1903 | 9,469,313.00 | 113,992,201.80
1903-1904 | 10,720,439.00 | 119,256,162.95
1904-1905 | 13,696,140.00 | 175,638,243.28
TOTAL $ | 52,162,691.00 | 358,873,405.03
£ | 10,432,538. | 71,774,681
GOLD PRODUCTION 1901-05.
YEAR | DOLLARS | £ STERLING
1900-1901 | 9,327,542 | 1,865,508
1901-1902 | 9,932,676 | 1,986,533
1902-1903 | 10,066,500 | 2,013,301
1903-1904 | 11,537,390 | 2,307,476
1904-1905 | 14429223 | 2885849
3,582,586
3,911,225
2,690,018
3,966,155
18,935,327
34,081,966
45,965,789

Plate 47.]

are exceedingly simple, titles are usually perfectly well secured, and the Government has done more, perhaps, to render the mining laws fair, just, and reliable, than that of any other country with which I am acquainted. It is but natural that in a foreign country disputes should occasionally arise, but such cases, however, are singularly few in Mexico, and they certainly receive a fair and impartial hearing, justice being done to both parties. Nor should there be any occasion to fear lawsuits if proper precautions are taken in the transfer of properties, and some native lawyer well acquainted with the Mexican law of titles is employed.

This is neither the time nor the place to discourse upon the question of mining titles at length; it is sufficient, probably, to say that while many titles to mining properties date back for hundreds of years, as a general rule this lapse of time is no impediment to their substantiation. Records for several hundreds of years exist, and although to the uninitiated some of the titles covering mining properties, upon first investigation, may appear rather involved owing to the number of individuals, living and dead, who are or were at one time interested in them, they are really simple enough compared with the titles, and the laws which cover them, existing in the United States of America. Those of Mexico certainly afford fewer loopholes for evasion and less chance for mere technicalities proving successful. It will, therefore, be recognized that foreign capital invested in Mexican mining enterprises is quite as safe as that invested in most countries, and a great deal safer than in some.

In this connection I may call attention to a recently organized concern called the "Mines Selection Company

of Mexico," having its principal quarters at Guanajuato and for its main object the rendering of a confidential and efficient service, not only to the mine-owners, mining companies, etc., but to prospective individual purchasers and shareholders. This company owed its inception to the ingenuity and enterprise, coupled with the ripe experience, of Messrs. MacDonald of Guanajuato, who are and have been for some years connected with the Guanajuato Consolidated Mining & Milling Company. Through their efforts and services, reports supplemented with maps and estimates of the costs of the most modern and economical mining and milling machinery, can be henceforth obtained, and also ideas gathered as to the most efficient methods of working the mines and conducting the extraction and treatment of the ores. For such prospective purchasers of Mexican mining properties who have no personal knowledge of the country, the services of men of experience like Messrs. MacDonald cannot be overrated. It is probably no exaggeration to say that there is no mining property in the Guanajuato District of Mexico with which these gentlemen are not intimately acquainted; and it is only necessary to recollect the fact that it was through them that El Real del Monte mines, at Pachuca, were disposed of to an American corporation under the most successful auspices. It is questionable whether any more brilliant coup than this has been carried out for a long time, and it is especially noteworthy from the fact that for a year previous attempts had been made in other quarters to complete the transaction, but without avail. The American company owning El Real del Monte mines to-day is one of the most powerful and influential corporations in the United States.

ELECTRICITY IN MINING.

The crude patio process of amalgamation for extracting the precious metals from the ore has, as I have shown, been superseded by mechanical appliances, and steam had hardly been adopted as an improved means of power in Mexico to replace man and mule when electricity became very generally and decidedly quickly introduced. This came about naturally enough in this Republic, where fuel is expensive and water power is available. Guanajuato, as a district, has been among the first to adopt electricity in all mining and milling possibilities. Not only is the expense of power reduced from one-half to one-third, but the conveniences which accrue and the possibilities which open with electric drive are unlimited. One has only to compare for a moment the simplicity of running two or three wires to electrically-driven pumps or compressors in a mine and working the same by steam-pipe with its wasteful condensation, to perceive and appreciate the advantages of the former method. With electric motors, the generating station (as compared with the boiler plant) can be located at practically any distance. The compressors can be placed near the work instead of piping air at a loss.

There is practically no modern machine about a mine or mill that cannot be motor-driven; furthermore, there is hardly a machine which is steam-driven that cannot be adapted readily to electric drive by a slight change in some part of its construction. Hoists, pumps, compressors, blowers, etc., in connection with mines and crushers,

stamp-batteries, tube-mills, mechanical agitators and excavators, sand-distributors, belt-conveyors, slime-pumps, etc., etc., in connection with mill and cyanide work, all lend themselves admirably to electric motor-drive.

Electric haulage for carrying ore from mine to mill, hauling tailings to the dump, etc., are all come into use at a great saving over the cost of hand or mule labor, as well as at an increase in output.

One of the advantages derived from an alternating current system is the great convenience of readily transforming the voltage to whatever is desired, in case machines are to be driven at some distance from the power plant, and thereby save in the copper required to transmit the power. Probably, the principal one is the possibility of using the squirrel cage type induction motor. This type of motor, properly constructed, is noted for the abuse it will stand. It has been compared to a grindstone in its simplicity. It will operate continuously without attention, and is provided with self-oiling bearings which require filling only infrequently. These motors should likewise be capable of withstanding excessive overloads and of being brought from an excessive overload to a full stop for a short time without sustaining injury. They have no brushes, commutators, slip-rings or other moving contacts, and are, therefore, entirely sparkless, so that no danger can result from fire. They will withstand exposure to a reasonable amount of dust, dirt and moisture, and do not require skilled labor to start or stop them. The multipoint auto-starters employed in starting them reduce the main line current at starting, serving to relieve the system greatly as well as the motor.

The extent to which electricity has been adopted corresponds very closely to the extent to which its possibilities, and the profits following its introduction, have become generally known. A parallel instance is the introduction of electric power distribution in factories. This progressed but very slowly, until a sufficient number of factories had been equipped to make the superior merits of electric power everywhere manifest. No one now hesitates to equip a new factory with electric apparatus, and in many hundreds of old factories the existing equipments of belts, shafts, pulleys, and other devices are being ruthlessly "scrapped" to make room for electric motors.

The advantages of electric power over other means of transmission are even more decided in the field of mining than in manufacturing plants, and a rapid increase in the use of electrical machinery is taking place in all branches of the mining industry. Electrical lighting of a mine and mill has not only proved a great convenience, but increases the output very considerably over the obscure method by candle illumination.

It may not be out of place here to cite an example of a saving over steam which occurred in the Western United States. Steam pumps were replaced by electric in a certain mine where the generating plant, motors, etc., cost $18,000 (£3,600), resulting in an annual saving of $6,000, allowing for interest on investment and depreciation of the plant. In another mine where steam hoisting was superseded by electricity, the hoists elevated the cage at 1,250 feet per minute, raising 500 tons daily from a 2,500-foot level by double-deck cages, carrying 3,600 pounds of ore. Up to the time that electricity

was adopted, the cost of motive power was never less than $20 (£4) per horse-power per month, which afterwards costs $7 (£1/8) per horse-power per month.

With steam it has formerly been necessary to drive long stamp-battery shafts with mills of 100 stamps or more. In Guanajuato, the Peregrina Mining and Milling Co., the San Próspero Mines Co., and the Guanajuato Amalgamated Gold Mines Co., which are now almost ready to start new mills, drive units of 20 stamps each by a 50 horse-power motor, thereby saving the long shafting losses and at the same time rendering it possible to shut down any one part of the stamps at any time.

In the handling of large quantities of comparatively low-grade ore these economies and improvements must not be lost sight of; nor have the mining interests in Guanajuato been guilty of this, as is clearly evidenced by the fact that the Westinghouse Electric and Manufacturing Co. of Pittsburg, Pa., U. S. A., have equipped throughout with modern electrical machinery the more modern mines and mills which are now about to operate.

Chapter XVI.

Some Guanajuato Men who Have Helped to Restore the District to Prosperity.—The Governor of Guanajuato.—The Firm of McElhiney & Bryant.—The Holdings Which They Control.—Mr. Geo. W. McElhiney.—Mr. George W. Bryant.—Mr. Frank G. Peck.—Mr. A. B. Carpenter.—Mr. J. J. Welch.—Mr. Percy H. Ramsden.—Mr. John C. Brennon.—Mr. Theodore Dwight.—Captain W. Murdoch Wiley.—Mr. C. W. Van Law.—Mr. Dwight Furness.—Mr. M. E. MacDonald.—Mr. Bernard MacDonald.—Mr. E. P. Ryan.—Mr. Lawrence P. Adams.—Mr. Norman Rowe.

SEÑOR Lic. D. Joaquin Obregón Gonzalez, the Governor of the State of Guanajuato, was born in November, 1843, and is therefore 63 years of age. He studied for the law, and in 1864 received the title of "abogado" (advocate). Entering politics as a profession, Señor Obregón was elected Deputy to the Congress of the Union in 1871, and continued to sit as a member of that body until its termination six years later, namely, 1877. President Lerdo de Tejada appointed Señor Obregón a Judge in 1876. He is and has been for many years a member of a number of learned and scientific societies, and he was duly elected to his present position as Governor of the State of Guanajuato in the year 1893. His Excellency is a thoroughly genial and capable man, extremely popular alike with the people and the commercial classes. At all times of public misfortune he has demonstrated his great sympathy for and active interest in the poorer people, while no popular undertaking ever

lacks his patronage and co-operation. Señor Don Joaquin Obregón Gonzalez lives in modest style, having the palace for his official residence in the City of Guanajuato, and a charming but very simple house for the summer months in the residential quarter of La Presa.

MESSRS. McELHINEY AND BRYANT.

These gentlemen have been interested in Guanajuato since the year 1895, when, as employees of other companies, they convinced themselves that Guanajuato was a camp second to none, and that it merely needed proper methods adapted to mining and milling its ores to make it one of the best known and most profitable mining camps in the world. Mr. McElhiney was connected from the beginning with the building of the plant of the Guanajuato Power & Electric Company, associated with Mr. Leonard E. Curtis and Mr. Henry Hine, of Colorado Springs. This is one of the most modern electrical transmission plants in the world, built for the purpose of supplying Guanajuato with cheap electric power. The establishment of this power company made it possible to mine cheaply the enormous bodies of low-grade ore known to be contained in the old mines of the camp, and at the same time encourage prospective work upon virgin ground, where it was practically certain that other great ore bodies existed.

Mr. McElhiney and his partner, Mr. Bryant, have been interested in the promotion of nearly every enterprise that is working in Guanajuato to-day, and have invested, and re-invested, in all those enterprises, thereby showing their absolute confidence in the future of the camp. At present they are officers and stockholders in the following companies:

The Peregrina Mining and Milling Company,
Guanajuato Development Company,
The Aparecida Mines Company,
The Victoria Mines Company,
The La Luz Mines Company,
The Guanajuato River Gold Mining Co.,
The San Matias Mining & Milling Company,
The Guadalupe Mining and Milling Company,
The Securities Corporation, Ltd.,
The Mexican Securities Company,
The Navidad Mines Company,
The Buenavista Mines Company,

while they are also very large stockholders in the following:

The Guanajuato Reduction & Mines Company,
The Guanajuato Power and Electric Company,

and owners of:

The Matilde Mine,
The Lepanto Mine,
The San Jorge Mine,
The Argentina Mine,
The Regie Mine,

and many others. These gentlemen are constantly on the alert to assist in the opening up and developing of good mining properties in Guanajuato. They have joined the Guanajuato Development Company in the opening up of the Pinguico mine, of which they were former owners, and in the Central group upon which they had erected a mill and which they were developing at the time that it was sold to the Guanajuato Development Company. They obtained for the last named company, under bond and lease, the great Cedro property.

From Mr. Dwight Furness, for many years American Consul at Guanajuato, Messrs. McElhiney and Bryant purchased the Nayal concentrating and amalgamating mill, which was for a number of years shut down, and have now changed it into a large cyanide plant, where purchased ores are treated by combined amalgamation, concentration and cyanide process.

This mill, it may be mentioned, is situated seven miles from the City of Guanajuato, is in the center of a gold district, and so much ore is constantly being offered that it is difficult to increase the mill rapidly enough to accept the ore. The ore being very easily treated by the cyanide process and the mines furnishing it in the immediate vicinity, it is possible to offer a very low treatment charge, thereby stimulating activity in the immediate surrounding district among small owners who have not the financial strength to build their own mills.

MR. GEORGE W. McELHINEY.

Mr. George W. McElhiney is a native of the State of Missouri, United States of America. He first came to Mexico some twelve years ago to enter the railroad-contracting business. His attention being called to the rich deposits contained in the Guanajuato River, his first experience in Guanajuato was with these deposits. It has needed years of experience to find out the proper way to treat these enormous tailings deposits, but Mr. McElhiney's patience and perseverance will probably see realized, in another year, the construction of an enormous plant which should produce profits of one million dollars per annum from this project.

Associated with American capitalists he sought a water power of sufficient capacity to supply 10,000 horse-power to Guanajuato, within a radius of 100 miles from that point, and was successful in procuring the Zamora waterfall, which now supplies all the power used in Guanajuato and in the neighboring cities.

In the many mine promotions instituted by Mr. Geo. W. Bryant and himself, his part was to raise the money; and in no case has he ever failed, as is evidenced by some eight million dollars (American money) being brought into Guanajuato through his efforts. Absolutely unknown in the financial centers of the United States when he commenced this work, his success evidences the impression which his sincerity and perseverance have made among investors.

Mr. McElhiney is now President of The Guanajuato Development Co. of 40 Wall Street, New York City; Vice-President of The Securities Corporation, Ltd., at the same address; Treasurer of the Peregrina Mining and Milling Company, also at the same address; and a director of many other mining and milling companies in Guanajuato. Guanajuato owes much to the tireless energy of this still young man, without whose work in raising capital it would have been absolutely impossible to carry out the many projects which are now attaining great success in the camp.

MR. GEORGE W. BRYANT.

Mr. George W. Bryant, the General Manager, is a thoroughly practical mining man, with a wide and varied experience in the Guanajuato Camp, where he has been a resident for over 12 years. Mr. Bryant has filled, and

filled with distinction to himself and every satisfaction to his colleagues, almost every kind of position available in over twenty different mining properties of this district. As a consequence, he acts as General Manager for, and holds the full power of attorney giving him absolute charge of their business and property, from some twenty corporations and individuals, representing nearly $20,000,000 of capital. He commenced his experiences in Mexico as an accountant and business manager of properties which were owned by the United Mexican Mines Association, Limited.

For some years Mr. Bryant remained as Resident Manager of this company, after which he became the General Manager of the Victoria Mines Co., and later on he had charge of the San Prospero Mines, the Refugio Mines, the Aparecida Mines, the Central group and many other equally important and successful properties in the Guanajuato Camp.

It is not only in this district, nor, indeed, in Mexico generally, that Mr. Bryant is known. As a clever and dependable mine-manager and expert, his opinions are sought and his judgments are quoted largely in the United States of America, while in Great Britain his assistance and ripe experience would, I feel assured, prove of considerable value to all who may be desirous of knowing something about the Guanajuato Camp from a man who is absolutely competent and thoroughly reliable. In Guanajuato there is no one who is more highly esteemed nor more genuinely popular than Mr. George W. Bryant, whose reputation as a distinguished and exceptionally capable mining-man is equalled by his personal popularity as an employer, born of a great

generosity of heart, justice to others, a liberality in his dealings with his fellow-workers and excellence as a citizen.

MR. JOHN J. WELCH.

No history of the District of Guanajuato would be complete without mention of the name of Mr. John J. Welch, whose experience, energy and abilities have contributed so largely to Guanajuato's recent mining renaissance.

To the alliance formed with Messrs. McElhiney and Bryant, in the fall of 1903, Mr. Welch has brought to bear a wide experience in the financing of new enterprises and the raising of money for the development and operation of mining properties.

The Securities Corporation, Ltd., in its year and a half of existence, through its selling organization, has secured from investors throughout the United States more than $3,000,000 of cash, all of which has been invested in Guanajuato enterprises, and the camp has changed from a comparatively unknown, far-distant field of operation to one of the best, most widely and most favorably known mining districts of the world.

Mr. Welch is President of The Securities Corporation, Ltd.; Vice-President of the Guanajuato Development Company which has for its object the acquisition, development and marketing of productive mining, timber, water and other properties and rights in the State of Guanajuato. He is also Vice-President of the Peregrina Mining & Milling Company, and Vice-President of the Pinguico Mines Company.

MR. FRANK G. PECK.

Mr. Frank G. Peck is a very well known miner of the State of Colorado, and more especially of Cripple Creek of that State, where he has been a resident as miner and operator for many years, also as large stockholder in and Secretary of the famous Portland Gold Mining Company, which pays $1,000,000 (£200,000) dividends annually. Mr. Peck, who is very favorably known to the mining public, is interested in many other large mining properties of Cripple Creek as well as of Colorado and the Western United States generally. He is a Director of the First National Bank of Colorado Springs, considered to be one of the strongest financial institutions west of the Mississippi River, and also of the Colorado Title and Trust Company, of Colorado Springs, besides being considerably interested in many other local institutions. As Secretary and member of the Executive Committee of the Portland Gold Mining Company, Mr. Peck is in constant and direct touch with the operation of that mine and of its large and successful mill at Colorado City. In the year 1900, Mr. Peck first became interested in Guanajuato, and from his first visit to the camp he felt perfectly convinced that it had a great future, only needing capital and proper mining and milling methods to make it one of the famous camps of the world of the future, as it had made itself in the past. Mr. Peck verified his sentiments by assisting in the organization of the Victoria Mines Company, of which he is President. He has constantly worked his San Prospero Mines, and is now building the 40-stamp mill known by the name of "San Matias," described upon a preceding page. He is President of

His Excellency Señor Lic. D. Joaquin Obregon Gonzalez.

Governor of the State of Guanajuato since 1893.

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and a stockholder in the Aparecida Mines Company; President of the Peregrina Mining and Milling Company; Treasurer and Director of the Guanajuato Development Company; Treasurer and Director of The Securities Corporation, Ltd.; Vice-President and Director of the Guanajuato River Gold Mining Company, and a very large stockholder in the Guanajuato Reduction and Mines Company and in the Guanajuato Power and Electric Company. Apparently Mr. Peck must have found his investments in Guanajuato highly profitable. Where so shrewd and cautious a man as Mr. Peck leads, even the most timid investor may safely follow; and his large holdings in the Guanajuato district may be accepted as an undoubted testimony to its value, otherwise he would scarcely have contnued to acquire them.

MR. A. B. CARPENTER.

Mr. A. B. Carpenter, who occupies the responsible position of Consulting Engineer, in conjunction with Mr. Brennon, to the Peregrina mine and group of properties associated with the Guanajuato Development Company, is a comparatively young man, but with exceptional ability and experience. For several years past he has been examining and reporting upon Mexican mines, and is consequently thoroughly familiar with the mining conditions and most of the mining camps of Mexico. Mr. Carpenter is an American, having graduated at the Beloit College of Wisconsin some thirteen years ago, after taking his degrees of Sc. B. & E. M. at the famous Michigan College of Mines at Houghton, Michigan. He commenced his experiences at the Cripple Creek and Victor gold fields, in Colorado. Coming to

Mexico, Mr. Carpenter speedily found his field of occupation, becoming identified with the Mexican Gold & Silver Recovery Company, Limited, which had and has extensive interests in this Republic. His reports are now accepted generally throughout the country as authoritative and absolutely reliable, and they carry great weight with both practical miners and shareholders in the Republic, as well as those in the United States of America and abroad.

MR. PERCY H. RAMSDEN.

Mr. Percy H. Ramsden is an Englishman and an admirable representative of his race in appearance, character and ability. At present in his forty-eighth year, Mr. Ramsden is regarded as one of the shrewdest and most reliable examiners of mining properties in Mexico. Born in London and educated at Chigwell, he came out to America about twenty-seven years ago, and was there connected with a number of prominent mines in the United States before coming down to Mexico. After spending about 18 months in the mining district of Chihuahua, Mr. Ramsden came on to Guanajuato, where he has since remained. Every property which Messrs. McElhiney and Bryant have since acquired either wholly or in part has been previously examined by Mr. Ramsden on their behalf, and it is a noteworthy fact that in all instances where fuller examination by the most experienced mining engineers has taken place, Mr. Ramdsen's opinions and findings have been substantially endorsed. His intimate knowledge of the entire district and his careful methods of procedure render his services especially valuable to his company

and his associates. Combined with a keen eye for opportunities and a high sense of his responsibility, Mr. Percy H. Ramsden possesses an attractive personality and as a consequence wields much influence.

MR. JOHN C. BRENNON.

Mr. John Clark Brennon, who is connected with the Guanajuato Development Company, was born in Washington, and is about 34 years of age. Educated at Georgetown University, he went to Michigan College where he remained for three and a half years. Thence Mr. Brennon went to Sonora, Mexico, and here as an employee of the British company, the Grand Central Mining Company, Limited, he saw a good deal of active employment. His position was that of Assistant Engineer, and after remaining in this capacity for three years Mr. Brennon travelled extensively through the States of Chihuahua, Sinoloa and again through Sonora. this time as a mining engineer. Subsequently, becoming interested with others in a small but promising mining property, known as the Ajuchitlan Mining and Milling Company, he spent four years in the capacity of Manager. His seven years' varied experience in Mexican mining has stood Mr. Brennon in excellent stead, since he is now a partner with Mr. A. B. Carpenter, the mining engineer already referred to above, in conjunction with whom he occupies the responsible and important position of Consulting Engineer to the Guanajuato Development Company.

MR. THEODORE DWIGHT.

Mr. Theodore Dwight, who is the recently elected President of the Mineral Development Company, al-

though a comparatively young man, being on the sunny side of 40, has seen a very considerable experience as an engineer, both electrical and mining. Born in 1868, Mr. Dwight received a thorough education in the United States, and in 1884, after five and a half years spent in Europe, became interested in gas-lighting. He soon afterwards connected himself with the Institute of Mining Engineers, and in the Autumn of 1890 he entered the workshops of the Thomson-Houston Electric Company, probably one of the finest training and finishing schools for electrical engineers in the world. In less than two years he became an assistant to the First Vice-President and General Manager. It is certainly a tribute to Mr. Dwight's ability and sense of responsibility that this important work was offered him after so comparatively slight an experience in the company's employ; and it is still more remarkable, perhaps, that upon quitting that concern's office he was offered and accepted a precisely similar position with the equally important New York concern, the General Electric Company. In 1894 Mr. Dwight was appointed Assistant Secretary to the American Institute of Mining Engineers, and resigned from that position in order to assume the presidency and management of the Mineral Development Company. Mr. Dwight has been elected Councillor and Director of the American Institute of Mining Engineers, and is a Trustee of the United Engineering Society formed to administer Mr. Andrew Carnegie's gift of $1,500,000 (£300,000) to the engineering profession of America. Mr. Dwight, who is a bachelor, is a very able administrator and a highly gifted conversationalist.

CAPTAIN W. MURDOCH WILEY.

Captain W. Murdoch Wiley, of the Mineral Development Company of Guanajuato, was born in Salisbury, North Carolina, and is of Scotch-Irish and French-Huguenot extraction. His first important experience was in connection with the 1877 North Carolina Geological Survey, and during the period between 1877 and 1884 he was principally at sea in various capacities, including that of the command of British and Danish vessels. From 1884 to 1885 he was at Trieste, Austria, in command of a Danish steam yacht, the "Adria," belonging to the Danish Minister at the Court of Vienna. From 1885 to 1886 he was in the U. S. Consular service in the South of France, while in 1887 he was a member of the "Figaro" expedition into the Sahara Desert for the purpose of determining the feasibility of inundating the Sahara and converting it into a navigable inland sea.

From 1888 to 1889, Captain Wiley was interested in a brokerage and commission business in London, and from 1889 to 1891 he was acting as the Engineer of Maintenance of Way on the Southern Railway, stationed at Asheville, N. C. He resigned this position to become the Managing Director of the International Trades Exhibition, Royal Agricultural Hall, London, and acted as the Special Correspondent of several English and American newspapers. In 1898, Captain Wiley took part in the Spanish-American War, after which, in 1889 to 1903, he took charge of the Standard Oil mining operations, in the Appalachian Belt. From 1904 to 1906 he acted as the President of the Mineral

Development Co., President of the Southern Development Co., Director of the Davis & Wiley Bank, and President and Director of various other American and Mexican Mining and Industrial companies. He is a member of the American Institute of Mining Engineers, of the Engineers' Club of New York, the Southern Society of New York, the North Carolina Society of New York, the Fulton Club of New York, the American Club of Mexico City, the Education-Rossers Academy of Navigation, London, and the Johns Hopkins University, Baltimore, U. S. A.

MR. C. W. VAN LAW.

As manager of the highly important group of mines belonging to the Guanajuato Reduction and Mines Company, Mr. C. W. Van Law occupies one of the most onerous and responsible positions in the camp. He is comparatively a young man; but, like most American mine managers to be found in Mexico to-day, he evinces all the brightness, discernment and shrewdness of his remarkable nation.

Mr. C. W. Van Law was born in 1874, and in 1882 he moved from Marietta, Ohio, his native town, to Colorado, which has been the cradle of so many clever and successful mining men. He was prepared for college in the excellent Chicago Manual Training School, where the rising generation of Americans are carefully taught to use their hands as well as their eyes and their brains. From this school Mr. Van Law went to the Cornell University, and entering the mechanical engineering course he graduated in 1896, with special honors for original research. Immediately upon grad-

uation, he went to the Tomboy mine, Telluride, Colo., there acting as assistant to the superintendent of mills.

In 1898 young Van Law became successively Master Mechanic and Mill Superintendent of the Columbia Menona Company, in the same district. Then he spent six months in the Yaqui country, of the Sonora State of Mexico, for the Sonora Development Company, being in charge of their ten mining enterprises. In 1889 he returned to Georgetown, Colorado, as manager of a silver-lead proposition located there.

In the same year, towards the autumn, Mr. Van Law was engaged by the intending purchasers of the Smuggler Union Property, in Telluride, Colorado, to make a series of metallurgical tests upon the existing plant, which was brought to a 500-tons-a-day capacity as the results of these same experiments. A considerable plant was also built for the same proprietors at Silverton, and a large hydro-electric installation was erected in Telluride.

In 1902 Mr. Van Law became associated with the famous machinery manufacturing firm—the Allis-Chalmers Company at Chicago, and in August, 1903, he was appointed as the Chief Engineer of their Mining Department, a position which he occupied until he was engaged to make an examination of the various properties of the Guanajuato Reduction and Mines Company, and ended by becoming their Resident Manager.

MR. DWIGHT FURNESS.

Mr. Dwight Furness arrived in Guanajuato in October, 1887, to take charge of the mines known as Calera and Cebada, and which now bear the name of Negocia-

cion Minera "La Esperanza." These properties were held by a St. Louis company called the Santana Mining Co. Owing to questions arising as to the form of lease, and also from the fact that the properties had been misrepresented, the business was dropped early in the following year. Mr. Furness then began buying ores for the Omaha & Grant smelter, through their representative, Wm. Mathews, and he associated with himself in this business the then United States Consular Agent at Guanajuato, Mr. Edward Williams. Then the firm became Williams & Furness.

The new firm lost money, however, the first six months, although they were doing a business of $50,000 per month. Mr. Williams shortly afterwards left the firm and the business was continued under the name of "Furness & Higby," until the end of the year 1889. The concern was now very successful.

The action of the Sherman law and the fluctuating price of silver caused suspension of ore-buying temporarily, but early in 1891 Mr. Dwight Furness resumed business in general merchandise, under the name of "Dwight Furness & Co." He shipped ores to Omaha and also to the Pueblo smelter, which was owned by the Messrs. Guggenheim. Up to the time of ore-buying by Mr. Furness, no ore had been shipped from Guanajuato to the United States, but ores, assaying over 300 ounces per ton, had been exported to Europe, the costs of freight and treatment amounting to over $50 gold (£10) per ton. The cost of freight to Omaha was $19 gold (£3/16) per ton and the treatment charge amounted to $16 (£3/4) gold per ton, the total

charge to the miner therefore being from $38 to $40 (£7/15 to £8) per ton of ore.

In 1891 the Messrs. Guggenheim established the smelter at Monterey, and since that time they have practically controlled the smelting situation in Mexico, and treatment charges have been steadily reduced until they now average about $25 to $30 Mex. (£2/10 to £3) per ton of ore. In 1892 Mr. Furness organized the concern into a stock company called the Furness & Lewis Co., and a very extensive business was done until 1896, when the concern was sold out to Lewis, Mr. Furness reserving the State of Guanajuato and continuing business under the name of Dwight Furness & Co., and later under the corporate name of "The Dwight Furness Co." The Furness & Lewis Co. did a very extensive business, amounting to about $2,000,000 per year, scattered through twelve agencies, distributed in the principal mining centers of the Republic from Chihuahua to Oaxaca.

Mr. Furness has always had control of these different companies, and he managed the business. The head company are still doing business of a little over one hundred thousand pesos per month, or $1,200,000.00 per year. In connection with ore-buying and merchandising, the company have done considerable mining, and still own a great deal of valuable mining ground in the States of Guanajuato and Jalisco. The Dwight Furness Company has also control of the San Gregorio R. R., some 30 kilometers long from Marfil to the San Gregorio mine, and is now arranging to continue the same from Marfil to Guanajuato and on to Irapuato, and from there to a connection with the Mexican Na-

tional at Salamanca, thus giving Guanajuato another trunk line railroad connection. Mr. Furness has been Consular Agent of the United States at Guanajuato since November, 1889, and his appointment bears the signature of James G. Blaine, late Secretary of State. He has been connected with most of the leading enterprises in Guanajuato, and is a Director of the bank, etc. Mr. Furness is everybody's friend, and probably does not possess an enemy in the world.

MR. E. P. RYAN.

Mr. Edwin P. Ryan, Manager of the Peregrina Mine, was educated at the Armour Institute of Technology, at Chicago, Illinois. He afterwards went to the Michigan College of Mines, which has turned out a great number of brilliant young engineers now occupying prominent positions in all parts of the world. Mr. Ryan graduated four years later (1900) with the degrees of Bachelor of Science and Engineer of Mines. He was the Mining Engineer of the Isle Royale Copper Company from 1900-1901. Subsequently he was appointed as Chief Engineer and afterwards Assistant Manager for the Mexican Gold and Silver Recovery Company, Limited, of London, of the Buena Vista Mines at La Yesca, Territory of Tepic, Mexico, and served there from 1901-1903. He then became the Consulting and Examining Engineer, as well as Chief Engineer of Construction, for the Kingston Copper Company, at Guadalajara, Mexico, staying there from 1903 to 1905, and this same year he was appointed Mining Engineer to the Securities Corporation, Limited, of New York and Guanajuato. In 1905 Mr. Ryan was

appointed General Superintendent of the Peregrina Mining & Milling Co. of Guanajuato, and remains in that position to-day. His wide experience embraces mining, milling, cyaniding and railroad engineering in all its branches, gained in the iron and copper districts of the United States and Mexico. Mr. Ryan is extremely well-liked by all who know him, and very highly esteemed by the company fortunate enough to have secured his services.

MR. LAWRENCE P. ADAMS.

Mr. Lawrence P. Adams, Manager of the Guanajuato Amalgamated Gold Mines Co., was born in New York City, July 26, 1873, and was educated at Phillips' Exeter Academy, Exeter, N. H., and at Harvard University, Cambridge, Mass. He first came to Guanajuato January, 1901, where he was engaged in prospecting until about June, 1905, becoming thoroughly familiar during that time with the mining conditions in and about Guanajuato. In the above mentioned month he closed an option for the "Negociacion de La Paz" group of mines, which includes the Jesus Maria, Villarino, Providencia, Sangre de Cristo, and Remedios, and shortly thereafter he succeeded in organizing the Guanajuato Amalgamated Gold Mines Co. to work those properties. Of this company Mr. Adams became the Resident Manager. The subject of this biography, it may be said, has made it a point to surround himself with the most able men in the various lines of the mining business that it has been possible to secure, and it is very generally conceded that the engineering and technical force at the mines has no superior in Guanajuato. One

of Mr. Adams' most capable and accomplished coadjutors is Mr. V. B. Sherrod, Constructing and Mining Engineer, and a man of the greatest ability. The company may be said to have been exceedingly fortunate in the possession of two such able officials as Mr. Adams and Mr. Sherrod, as well as Mr. E. Harris, the Chief Miner and Superintendent of the underground workings, lately with the El Ore Mining and Railway Company, Limited.

MR. NORMAN ROWE.

Mr. Norman Rowe, Manager of the Guanajuato Power and Electric Co., graduated from Cornell University, 1903, with degree M. E. with special reference to work done in electricity. After graduating, he spent five years with the Westinghouse Electric and Manufacturing Co., most of that time being passed in the testing department. Mr. Rowe eventually left the employ of the Westinghouse Co. to accept the position of Electrical Engineer for the Compañia Industrial de Orizaba, Mexico, for the construction of an important electrical transmission plant near Orizaba. After finishing the work at Orizaba, he went to California as engineer of the San Francisco office of the Westinghouse Electric and Manufacturing Co., and from there he came back to Mexico City as Chief Engineer of the San Ildefonso Hydraulic and Electrical System. During this period the six hydraulic plants were finished there and put in operation, and a complete underground and overhead system was installed in Mexico City, together with an auxiliary steam and storage-battery plant. Mr. Rowe subsequently came to the Guanajuato Power and

Electric Co. at the time that the construction work was commenced, and has remained with them ever since. In all probability Mr. Rowe's name will be shortly mentioned with distinction in connection with a new and recently-patented insulator which has been invented by him and extremely well received by experts in the electric world.

MR. M. E. MacDONALD.

Mr. M. E. MacDonald, Manager of the Guanajuato Consolidated Mining and Milling Company, began his mining career in the Rocky Mountain regions of the United States in 1883. From then until 1893 he spent his time in the various practical branches of mining, mastering, as he went along, every detail of the practical work. Beginning with 1888, he occupied the responsible positions of foreman and mine superintendent in the largely producing mines of Colorado, Idaho and Montana. In 1898, he went to Zacatecas, Mexico, to accept the management of the San Cristobal Mining Company at that place, and in the following year he went to Guanajuato to take the position he now occupies with the Guanajuato Consolidated Mining & Milling Company, that concern having been just organized to take over and operate the Sirena Mine. At this time the Sirena Mine, which is now one of the largest producing mines in Guanajuato District, was full of water to the tunnel level, and work on it had been suspended by its Mexican owners, because it could no longer be worked profitably by them.

The problems involved in the drainage and exploration of this mine were then undertaken and mastered,

and a pan-amalgamation milling plant, operated by steam, was erected on it. This cost of operating the mining and milling plants by steam, as the only motor power then available with fuel at prohibitive prices, coupled with a low percentage of extraction in the mill of the values in the ore, left little or no profit. Hope was kept alive by prospect of cheap electric power being brought to the camp and by the large bodies of low-grade ore, which were being developed in the deep levels of the mine. On the advent of electric power, complete plants of electric motors for mine and mill were installed, and, although the expenses for power were lessened thereby, this was more than offset by the increasing baseness of the new ore-bodies developed in the deep levels. Finally, this new evil was overcome by the abandonment of pan-amalgamation and the substitution of the cyanide process, which has given remarkably satisfactory results from the beginning. The manager, very naturally, feels proud of this outcome of his struggle with this property, since the mine has now entered the dividend-paying list, and the shareholders, among whom he is one of the largest, have expressed their confidence in his judgment by electing him to the Board of Directors.

MR. BERNARD MacDONALD.

Mr. Bernard MacDonald, the Consulting Engineer of the Guanajuato Consolidated Mining and Milling Company, began his mining career in California, in 1874. At this time, practical experience was the only road to the mining profession. All lode mines were then operated under the direction of Cornish mine captains,

or miners of other nationalities who acquired all the mining knowledge they possessed by practical experience, and the same was true of the milling operations. From 1874 till 1880, Mr. MacDonald worked in the various branches of practical mine work, in the lode mines of Grass Valley and other mining camps in California, and in the large mines on the Comstock lode, and elsewhere in the State of Nevada, having, previous to this experience in practical mining work, completed a course in civil engineering, as well as the practical side of mining and milling operations. In the year 1880 he went to Leadville, Colo., to take the position of Mine Superintendent with the Little Chief Mining Company. After two years in Leadville he engaged as Superintendent of the famous Lake Valley Mines of New Mexico.

After spending some years in exploration of the new mining regions, then made accessible by the advent of railroads in New Mexico, and in mining on his own account, Mr. MacDonald engaged as manager with a company which had undertaken the reopening of the famous old Santa Ana Mines of Sonora, mentioned in Ward's "History of Mexico." Afterwards he continued mining in Montana, Idaho and British Columbia, being occupied as Manager or Consulting Engineer for several mining companies. In 1904 he was engaged to go to Guanajuato to make a study of the mines of the Guanajuato Consolidated Mining and Milling Company, and the metallurgical problems involved in the treatment of their ores. After reporting the results of this study he was enaged as Consulting Engineer to the company. The cyanide plant was designed by him

and erected under his immediate supervision. The work devolving on him now, by reason of this position with the company, occupies only a part of his time, the remainder being devoted to the business of the Mines Selection Company of Mexico, of which company he is President. It may not be out of place to repeat here that the recent sale of the Real del Monte mines at Pachuca, which, by the way, are perhaps by long odds the largest aggregation of real mines in the Republic of Mexico, was consummated by him, at the price and terms of an option obtained from the President of the company. The Manager and the Consulting Engineer of the Consolidated Mining and Milling Company are brothers, and were born near Belfast, Ireland, of Scotch-Irish parentage. They came to the United States when young men, and are citizens of the latter country.

Conclusion.

THE great questions which investors will have to satisfy themselves upon, after they have been convinced that the ores exist in large quantities, are how much does it cost to mine and treat the ores, what are the total management expenses, and how much net profit remains thereafter? These questions may be briefly replied to as follows: Even for deep mining on the Mother Lode at Guanajuato, $4.50 (Mex. Cy.), say 9/s., per ton of ore may be accepted as a liberal allowance for mining costs (apart from milling) under modern mining practice. The present price of stamping the ore through a forty-mesh screen, allowing for all supplies, general expenses, etc., is not above $1.75 (Mex. Cy.) per ton of ore, including the cost of concentrating the pulp upon Wilfley tables. The cost of pan-amalgamation of the tailings has hitherto been less than $4 (Mex. Cy.) per ton, while the cost of cyaniding will be under $3 (Mex. Cy.) per ton. Therefore, a cost of $4.50 for mining and a total cost of $5 (Mex. Cy. = $2.50 U. S. Cy.) per ton for all milling operations, may be accepted as a liberal estimate of cost for future mining and milling operations at Guanajuato. A total recovery of 90% of all the values of the ores is readily obtainable by concentration and cyaniding.

From the 90 per cent. bullion recovered, there must be deducted 5 per cent. for express charges and Government taxes on bullion. This would leave about 85 per

cent. net return in bullion of the original gold and silver contents of the ore. Consequently, the total cost for mining and milling will not exceed $9.50 (Mex.) per ton, even in deep mining. Ore containing as low values as $12.50 Mexican currency ($6.25 U. S. Cy. or £1/5) in silver and gold per metric ton, can be successfully mined and treated at Guanajuato. Most of the mines here are treating much richer stuff than this, however, but it is satisfactory to know that with the enormous reserves of comparatively low-grade ore available, the mills of Guanajuato must be kept busy for many a year to come and give the camp that most desirable of reputations—"permanency."

Some of the illustrations which I give showing the old and wearisome methods of working the Guanajuato mines should prove of interest to those who are mainly concerned in the economy and effectiveness of modern methods. In place of old black powder, combined with hand-drilling as a means of breaking the rock in the mines, we have to-day the most powerful explosives and air-compressor rock-drills. Instead of the horse-whims, sometimes worked by as many as sixteen horses, we have the modern electric hoist, and in place of the water-buckets, hauled up by the slow overhead drums, we find powerful pumps doing the work in a hundredth part of the time and at a hundredth part of the cost.

It is estimated that the average contents of the ores found in the Mother Vein at Guanajuato are about 13½ grams gold to each 1,000 grams of silver. This means that of the combined gold and silver values of the Mother Lode ores, before the year 1820, the value of gold represented about 17 per cent. and silver 83 per

cent. To-day the commercial ratio of gold and silver values has increased the gold values in Guanajuato ores to about 30 per cent. and reduced the silver to 70 per cent. In the gold belt such as Peregrina and the mines of the Guanajuato Development Company, the gold is about 70 per cent. of the total value of the ore, thus affording a marked distinction from the above mentioned mines. The mint records before 1820 show an average value of gold bullion of 3.8 per cent. of the total bullion value, or, with an estimated recovery of 87½ per cent. of the silver values in the patio process, a recovery of the gold values of the ore of about 4¼ per cent., and a consequent loss of about 12¾ per cent. of the 17 per cent. gold values of the ore. It would, however, be unfair to charge this loss of 75 per cent. of the gold values entirely to the patio process. No doubt the greater part of the loss was incurred through this process, as most of the gold, especially in the ores containing sulphurets which come from the lower levels of the mines, was lost, being carried away in the tailings, or possibly in solution.

When the cyanide process was first introduced into the Guanajuato mines, it did not receive a very hearty welcome. The first mine at which experiments were tried was Cubo, now the property of Mr. Thomas H. Leggett, of New York, and others. It was found that while the consumption of cyanide was low, the extraction was low also, the average being from 40 to 85 per cent. of the silver and the gold in the ore, the time for treatment allowed being about 16 hours. But for the intervention and strong representation of some prominent mining engineers who were interested in Guana-

juato properties and also in the MacArthur-Forrest process, it is doubtful whether the cyanide process of treatment would have found many friends in Guanajuato at all. Further tests took place both at Cubo and Sirena, the latter now being the property of the very successful Guanajuato Consolidated Mining and Milling Co., and with far better and more encouraging results. Some of the tests recovered as much as 92.5 and 94.5 per cent. of the total value of the ore, the yield being concentrate and bullion. With these results before them, then, the Guanajuato Consolidated Mining and Milling Co. installed their present plant with a capacity of approximately 200 tons per diem, and of which a fuller detailed description will be found in the earlier chapters of this book.

Tests made by Mr. Francis J. Hobson, Chief Chemist of the MacArthur-Forrest Cyanide Co., upon some Valenciana ores resulted in further plants being established, an 80-stamp mill at the Bustos and the cyanide plant at the Hacienda de Flores being installed. In 1904, the Cubo mine also installed a cyanide plant, and it is still running very satisfactorily. At the Peregrina mine from 94 to 95 per cent. of the precious metals have been extracted by means of the cyanide and concentration plant since 1905, and another 100 stamps are going up at the present time with a cyanide annex. At the Central mill a cyanide plant is in operation, and another is now completed at the Nayal mill. At the Hacienda San Matias, belonging to Mr. Frank G. Peck, of the Portland Gold Mining Company of Cripple Creek, Colorado, who is President of the Peregrina Mining and Milling Company of Guanajuato, a

cyanide plant is fast approaching completion, while a Mexican mine-owner named Señor Ibarbuengoitia has converted his patio process to cyanidation. At La Luz, the Guanajuato Amalgamated Gold Mines Company are erecting 100 stamps on the Jesus Maria Mine, with a cyanide plant. Taking all the plants collectively, about 700 tons of ore are being cyanided daily at Guanajuato, but in a few months' time, in all probability, this will have increased to some 1,400 tons per day.

So pronounced have been the successes achieved by the experiments at Guanajuato upon cyanidation of silver on silicious ores that the process is removed entirely from the region of doubt, and is now generally accepted as having reached that of a certainty. It was proved that while the employment of extremely weak solutions of potassium (or sodium) cyanide was advantageous to the reduction of gold ores, it was found prejudicial to silver; now, however, that stronger solutions and more time are being employed, very different results are being achieved. It is said that experiments upon a large scale have proved that even a vanner concentrate, containing silver sulphide associated with pyrite, is amenable to profitable treatment by cyanidation.

What threatened at one time to become a long and troublesome case of litigation between the Guanajuato mines and the local representatives of the MacArthur-Forrest process (the Mexican Gold and Silver Recovery Co., Limited), fortunately terminated amicably. Towards the beginning of this year the Guanajuato Reduction and Mines Co. were sued by the agents of the cyanide patents for infringement, and the matter pro-

ceeded sufficiently far to secure the Bustos mill at Guanajuato being enjoined by the local judge, and his official seals being put upon the doors and cyanide vats. It looked as if every one of the companies using a cyanide plant would join in and make common cause with the Reduction and Mines Co., and, but for wiser counsel prevailing, this would have happened. But the agents proving reasonable and far from vindictive, a compromise was effected, the law being undoubtedly on the side of the patentees and common sense on the side of the mining companies.

The great uncertainties of mining are too well known and have been too often experienced to need much comment. In the mining district of Mexico as in all others which I have visited in different parts of the world, great surprises and intense disappointments are continually being experienced. The most promising floors or chutes which even an experienced miner may deem certain to hold out for a good area, suddenly become interrupted by sterile portions which no one could have foreseen, or are diminished in their thickness or reduced in value. On the other hand, poor and apparently worthless portions of a lode, regarded as of no value at all, have unexpectedly shown rich ore chutes or even "bonanzas." Again and again has this proved the case among the Mexican mines, so that every recurring day has its delights as well as its delusions.

The surest way to distribute the dangers and at the same time equalize the successes of mining is to distribute one's eggs through many baskets; in other words, hold and work several mining properties simultaneously. The best method to ensure success—all-round success

bien entendu—in a lode-mining country like Guanajuato, for instance, is to carry on operations upon several independent and proved mining claims, so that at least one of them may be certain to flourish, while one of the others may be in a state of development or temporary falling off in returns, after having yielded a considerable output. Economies in management can also be effected. This is the case with practically all the Guanajuato companies, each of which possesses several mines, not all contiguous either, and thus its interests are carefully spread over a large area with every prospect of some, at least, turning out "trumps" and, not improbably, all of them in due time.

THE END.

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